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ERRATA.

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"Heurnius and Hermann, the Earliest Known Plant Collectors at the Cape". by Mia C. Karsten.

PLATE V. Fig. 1. *Huernia zebrina* N.E.Br.
Fig. 2. *Huernia hystrix* N.E.Br.

)ENS
OF SOUTH AFRICA
KIRSTENBOSCH, NEWLANDS
CAPE PROVINCE

EDITOR

H. B. RYCROFT, M.Sc. (S.Af.), B.Sc. For. (Stell.), Ph.D. (Cape Town), F.L.S.

DIRECTOR OF THE NATIONAL BOTANIC GARDENS OF SOUTH AFRICA.
HAROLD PEARSON PROFESSOR OF BOTANY IN THE UNIVERSITY OF CAPE TOWN

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A NEW SPECIES OF SALSOLA WITH NOTES ON ITS AFFINITIES*

By I. C. VERDOORN
(*National Herbarium, Pretoria*)

Salsola henriciae Verdoorn, sp. nov.: in speciebus bracteis oppositis, bracteis strigosis, plantis humilibus radicantibus, arena obtectis, 2—15 cm. altis distinguitur.

Suffrutex humilis, arenicola; rami divaricati, arena obtecti, saepe stoloniferi, ramulis erectis, 2—15 cm. altis. *Folia* squamiformia, carnosa, opposita, ovata, dorso rotundato-carinata, strigosa, nonnunquam deinde glabrescentia, c. 2 mm. longa, 1·75 mm. lata, apice obtusa, basi hyalino-auriculata, marginibus hyalinis minute ciliatis. *Bracteolae* 2, foliis similes sed usque ad 3 mm. longae, dorso valde carinatae. *Flores* solitarii axillares, apicibus ramulorum pseudostrobilati. *Sepala* 5, ovato-oblonga, circa 3 mm. longa, membranacea, medio leviter incrassata, dorso strigosa. *Stamina* 5. *Ovarium* ovoideum, in stylum longum bifidum productum. *Fructus* utriculus. *Semen* orbiculare; embryo sub-cochleato spirali.

ORANGE FREE STATE. Fauresmith: farm Rosemarie near Luckhoff, *Henrici* 3187; 3188; 3892; 3897 (PRE, holotype); 3897a; 4532; 4533; 4543; 4544; 4588; 4589; 4592; 4593; 4597; 5224; 5225; 5231; 5231a; *Verdoorn* 1629; 2147; *Brueckner* 690; 11 miles north-west of Luckhoff; *Acocks* 13508; 12 miles west of Luckhoff; *Sidey* 533; Panfontein, near Koffiefontein; *Henrici* 4506; 4509; 4478; 4477; Poortjiesdam, *Henrici* 4500; 4505.

*Presented at the Bloemfontein Congress of the South African Association for the Advancement of Science (1954).

A low suffrutex with woody branches spreading and rooting under the sand, the ultimate branchlets erect, 2—15 cm. long above ground. *Leaves* opposite, bract-like, fleshy, ovate, about 1·5—3 mm. long and 1·75 mm. broad, concave, dorsally rounded and somewhat carinate, strigose with appressed, translucent, acute hairs, glabrescent, apex subacute, base spurred, with a tuft of hairs below, margins hyaline, minutely ciliate. *Bracteoles* 2, similar to the bracteate leaves, but somewhat longer, 3—4 mm. long, more distinctly carinate and sooner glabrescent. *Flowers* solitary, sessile, axillary, forming pseudo-strobiles at the apices of branchlets. *Sepals* 5, ovate-oblong to lanceolate-oblong, the outer the largest, 3·5 mm. long, 1·75 mm. broad, the innermost about 1·25 mm. broad, strigose dorsally, all membranous, but at least the outer developing a thickened green triangular area at the middle or in the upper half; the triangle faintly reticulate and in fruit producing small tubercles at the base (not the usual membranous wing). *Stamens* 5, inserted in the membranous annular disc, filaments linear membranous, up to 3 mm. long, anthers dorsifixed, about 1 mm. long. *Ovary* subglobose, about 1·5 mm. long and 1·25 mm. broad, produced into a 2-fid style, about 1·5 mm. long. *Fruit* a utricle. *Seeds* orbicular, embryo obvious through the transparent walls, subcochleate.

The new species occurs quite frequently in the south-western corner of the Orange Free State and has been collected at intervals in this area during the last 19 years. Dr. Henrici has sent in many specimens collected on different parts of Mrs. Mudd's farm, Rosemarie, near Luckhoff in the Fauresmith district. She has also collected it at Poortjiesdam and Panfontein which lie to the north of Luckhoff and nearer Koffiefontein. Other collectors have sent it in from 12 miles west and 11 miles north-west of Luckhoff. In all these years, it has not been found outside this rather circumscribed area except for a somewhat doubtful specimen collected at Potfontein in the Philipstown district, that is just across the border of Fauresmith district in the Cape Province. This specimen is slightly different from the 30 odd other specimens and until that locality can be visited again or specimens be sent in from there, it must remain doubtful. It is possible that it might be a hybrid with *Salsola rabieana* which, at Rosemarie, grows on the limestone ridges near the pan on whose fringes the new species grows. (It has not yet been established whether or not Salsolas hybridize in the wild state but it seems very probable that they do.)

In the new species the feature which is striking, at least in the Herbarium, is that the bract-like leaves are distinctly opposite. This feature is shared with at least two other described South African species, *S. humifusa* Brueckner and *S. geminiflora* C. H. Wr. Another characteristic common to these three species is the absence of the dorsal wing on the mature perianth. In place of it some tubercles, or a thick spur, may develop, but to date no specimen has been found

with the horizontal wing which develops on the fruiting perianth of the species which have alternate bracts. This, however, is not very useful as a diagnostic character because the wings develop only on the mature perianth and at some stages it cannot be determined whether a specimen will have wings or not.

The distinguishing features of the new species and its allies with opposite bracts are shortly described below.

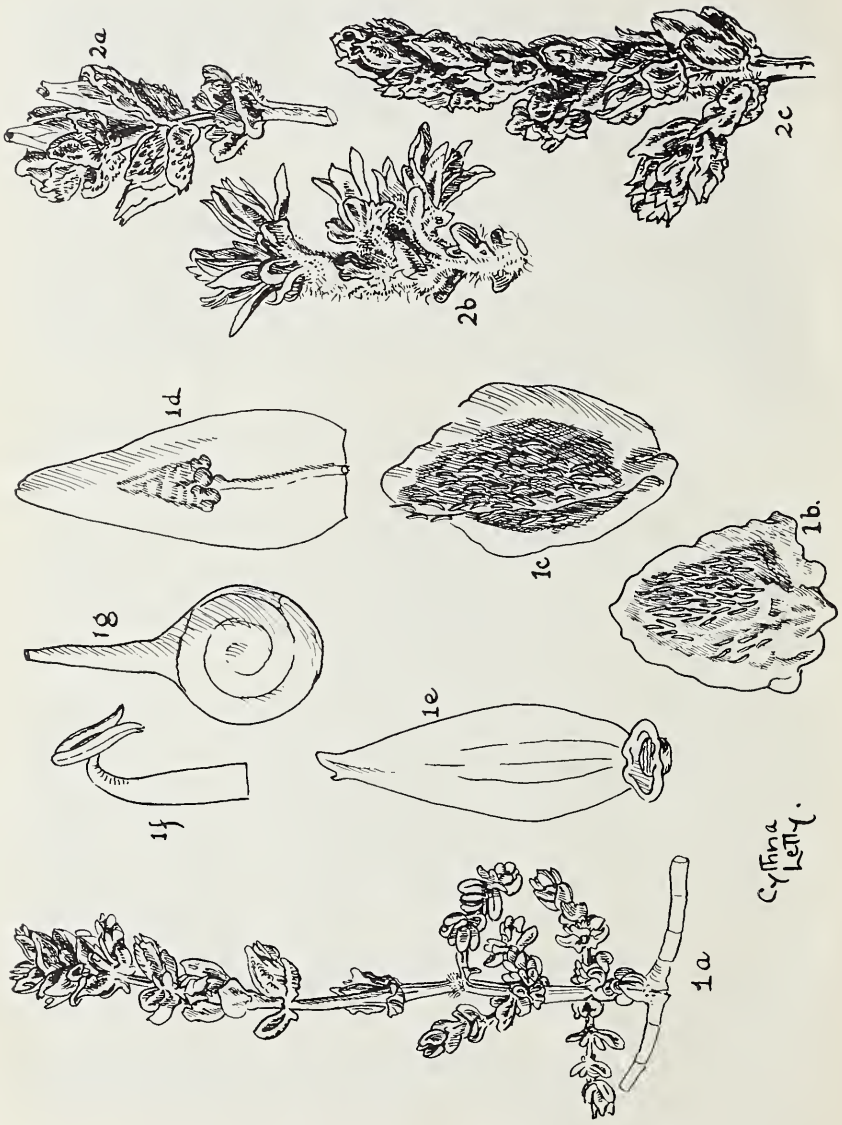
Salsola humifusa Brueckner is characterised by the procumbent habit, the long rather slender runners creeping on top of and close to the ground, forming mat-like growths, and the runners sending out roots at intervals. The rather thick, ovate bracts are very small, about 1·5 mm. long, practically glabrous or with a sparse loose pubescence which is mostly at the base of the bract and on the twigs. This species has been collected in the Philipstown and Kimberley districts in the Cape and the Fauresmith and Hoopstad districts in the O.F.S. One collector of this species notes that it grows on the fringes of purely saline pans.

Salsola henriciae, the new species, is a dwarf plant but usually does not grow as flat as *S. humifusa*. Usually the plants are half buried by sand and so form mounds, the ramifications under the surface are quite thick and divaricate and root at the joints. The ultimate erect branches are 2—15 cm. high above ground. The bracts are slightly larger than in the preceding but of the same ovate shape and hardness and they are usually strigose with appressed, translucent, pointed hairs. It occurs in the south-western corner of the Fauresmith district near Luckhoff and Koffiefontein where it has been found on and near pans with deposits of carbonates and sulphates.

S. geminiflora C. H. Wr. is usually taller (about 30—45 cm.) than either of the previous two species, more or less erect in habit with some branches occasionally decumbent and rooting where they touch the ground. The bracts on the lateral twigs are often so dense that when flowering they form strobile-like inflorescences. When these are numerous the plants become top-heavy and that causes the branches to fall over on to the ground and root as described above.

In comparison with the two previous species the bracts are more succulent and almost subglobose with loose spreading pubescence at the base. According to present records, this species is much more widely spread and is not so specialized in its requirements as the other two. It has been collected in the Van Rhynsdorp, Calvinia, Williston, Carnarvon, Philipstown, Kenhardt, Gordonia, Herbert and Kimberley districts of the Cape Province and the Fauresmith district of the Orange Free State. This range brings it to the vicinity of both the other species.

In South Africa, *S. geminiflora* provides the link between the species with opposite bracts and the more numerous species with alternate bracts, for all the bracts are not opposite.


2a
2b
2c
1d
1c
1b.
1g
1e
1f
1a
Cyttina
Lehy.

Among the group with alternate bracts it is allied to *S. aphylla* which has similar succulent bracts, salty to the taste when fresh, but the plants grow up to 2 m. tall. In *S. aphylla* the fruiting perianth is very conspicuously winged while no wings have been found on any of the numerous specimens of *S. geminiflora* examined to date.

KEY TO SPECIES WITH OPPOSITE BRACTS.

Procumbent, flat-growing plants; bracts glabrous or with loose pubescence at the base, about 1·5 mm. long .. .. *S. humifusa*
Plants not flat-growing; bracts over 1·5 mm. long:
Plants 2—15 cm. tall; bracts strigose dorsally .. .. *S. henriciae*
Plants up to 45 cm. tall; bracts glabrous or loosely pubescent at the base .. .. *S. geminiflora*

1. *Salsola henriciae* Verdoorn sp. nov. 1a, branchlet showing opposite bracteal-leaves, the upper with flowers in the axils; 1b, bracteal leaf, × 14; 1c, bracteole, × 14; 1d, one of the outer sepals, dorsal view, dark triangular area above the middle with a few tubercles at the base, × 14; 1e, one of the inner sepals, ventral view, × 14; 1f, stamen, × 14; 1g, utricle, pericarp becoming transparent and showing the spiral embryo within, × 14.
2a, *S. henriciae* Verdoorn, top of flowering twig; 2b, *S. humifusa* Brueckner, ditto; 2c, *S. gemmiflora* C. H. Wr. ditto.

NOTES ON MESEMBRYANTHEMUM AND ALLIED GENERA

H. M. L. Bolus

Dactylopsis littlewoodii L. Bol. sp. nov.—A **D. digitata** (Ait.) N. E. Br. habitu multo humiliore, caule tam reducto ut fere inviso esse, ramis primariis omnibus radicibus onustis, folio immo ortus hornotini, ubi viso, bene evoluto nonque ad vaginam tantum reducto, folio secundo vel tertio maximo, ascendente vel patente, compresso, lat. viso oblongo vel oblonge ovato vel ovali, ad 2·8 cm. longo cum vagina 8 mm., ad 1·3 cm. diam., distinguitur.

Plantae 2·5—3 cm. altae; folia lat. visa apice rotundata, 7—28 mm. longa, 3—14 mm. diam.; flores eis **D. digitatae** simillimi; receptaculum conspicue papillatum, 4 mm. longum, ad 5 mm. diam.; calycis tubus 3—4 mm. longus, segmentis 2—5 mm. longis; corolla 1·4 cm. diam. vel demum ad ca. 1·6 cm., tubo ad 3 mm. longo; stamina ad 5-seriata, superiora demum breviter exserta; stigmata 1·5 mm. longa.

Cape Province: Namaqualand, "10 miles N. and 5 miles E. of Bitterfontein", Oct. 1960, *R. C. Littlewood*, Karoo Garden 308/60. Fl. Nov. 1961.

For three flowering seasons this species has been grown in the Karoo Garden under close observation, side by side with **D. digitata** "on an open scree in full sun. It has come through one of the dampest winters people can remember, the rainfall being over 11 inches with long periods of mist and drizzle". (*Stayner*). Throughout it has maintained its original dwarf form, as well as the stilt-like roots subtending each primary branch, the almost invisible stem, and the ascending or spreading, differently shaped, and much shorter leaves—distinguishing characteristics which were fully noted by the discoverer and found to be constant in all the considerable number of plants he saw.

The leaves in one flowering growth seen were as many as 5, including the shrinking basal one, which in this case was fleshy with a short blade, and not the bladeless sheath that seems to be usual in **D. digitata,** where "2—3 alternate sheathing leaves" are recorded in the description (Gard. Chron. 83:339), no mention being made of the basal sheath. In the more usual 4-leaved growths the largest is the second leaf and in the 5-leaved one the third leaf. In profile these may be oval, oblong, or oblong-ovate, ascending or spreading, "less than 45° from the horizontal or in some cases the *tips* are horizontal". (*Stayner*).

Cheiridopsis vanbredai L. Bol. sp. nov. (*Bibracteata*).—Planta 1 visa, dense compacta, 6 cm. alta, 11 cm. et 13 cm. diam.; caulis apice 2 cm. diam.; rami floriferi 4-foliati vel rarissime 2-foliati; folia ascendentia, supra visa plana, ovata vel lanceolata, e parum supra basim angustata, acuta, novella conspicue

apiculata, matura superne obtuse carinata, lateribus planis vel cum aetate convexis, lat. visa inferne interdum leviter angustata, apice truncata, breviter 2-lobulata, lobulis conspicue aristatis, cum aetate obscuris, viridia politaque (in siccis minute punctata) vel senecta glauca crassiora (in siccis minute margaritaceo punctata), ad 3 cm. longa cum vagina 9—13 mm., basi ad 1·4 cm. lata, 8—12 mm. diam., superiora ad 3·6 cm. longa cum vagina ad 7 mm.; pedunculi ad 5 cm. longi, cum receptaculo sepalisque tactu velutini; bracteae foliis simillimae, 1·5—2 cm. longae cum vagina ad 5 mm.; receptaculum semiglobosum, 5—6 mm. longum, 8—10 mm. diam.; sepala 5, e prope basim superne angustata, acuta vel acuminata, 8—11 mm. longa, basi 4—8 mm. lata; petala ca. 6-seriata, interiora pauca, inferne leviter angustata, obtusa vel acuta, externe pallide rosea, interne pallidiora vel albida, 7—35 mm., saepius ad 30 mm., longa, 0·75—1·75 mm. lata; filamenta ca. 6-seriata, conice conferta, mox suberecta, alba, ad 7 mm. longa, antheris griseo purpureis, polline pallidissime griseo; ovarium e disco gradatim ad 0·75 mm. elevatum, lobis inconspicuis; stigmata 10, inferne anguste subulata, e medio superne attenuata, ad 7 mm. longa.

Cape Province: Namaqualand, Richtersveld, "on the farm, Gemsbokvlakte, situated on the road to Stinkfontein—just off the main road from Steinkopf to Port Nolloth", *P. A. B. van Breda* 1768/61. Fl. Veld Reserve, Worcester, Sept. 1962.

Conophytum christiansenianum L. Bol. sp. nov. (*Derenbergia* § *Cordiformia*).—Plantae 2 visae, cultae, 5—7 cm. altae, ad 8 cm. diam.; rami primarii inferne reliquiis sat tenuibus vestiti, internodiis inclusis; corpuscula lat. visa obovata vel oblonge obovata, breviter velutine pubescentia, in siccis asperula, subglauce viridia, interdum superne leviter roseo suffusa, 3·5—5 cm. longa, prope apicem 2·2—2·8 cm. diam. cum fissura 7—12 mm., medio vaginae 1·4 cm., vel cum aetate et gemmis axillaribus evolutis ad 1·8 cm., lata, 1·5—1·8 cm. diam., lobis 8—22 mm. longis, basi 5—9 mm. latis, prope apicem 7—13 mm. diam., lat. visa prope apicem rotundatis, apice subtruncatis, integris vel saepissime 2-lobulatis, lobulo anteriore acuto, ad 5 mm. longo, posteriore obtuso breviore cumque aetate obscuro, pustula inconspicua, cum ore breviter pilosa; flores 3 visi, in maximo pedunculus 2 cm. longus, prope basim bracteatus, bracteis membranaceis, 7 mm. longis, vel in fructu immaturo ad 14 mm. accrescentibus; receptaculum 1·5 mm. longum, ad 3 mm. diam.; calyx ad 8 mm. longus, tubo membranaceo, segmentis 5, herbaceis, late marginatis, 2—3 mm. longis; corolla 2·3 cm. longa, tubo superne leviter ampliato, pallido, 1·1 cm. longo, segmentis 2-seriatis, apice rotundatis, luteis, ad 1·5 mm. latis; stamina 7-seriata, lutea, superiora sat breviter exserta; ovarium conice ad 0·75 mm., vel in fructu immaturo ad 2 mm., elevatum; stylus ad 9 mm. longus, stigmatibus 5, ca. 3 mm. longis.

Cape Province: Namaqualand, "22 miles S. of Springbok, growing with *C. hallii*", Nov. 1961, *R. C. Littlewood.* Karoo Garden 965/61. Fl. Feb. 1962.

Mr. Littlewood, describing the habitat of this species as being "one of the typical Namaqualand granite boulders", saw "on this particular one, within a radius of 50 yards, 4 species of **Conophytum,** on the north side **C. pellucidum,** on the south-west **C. hallii,** almost at the summit **C.** sp. (*Cataphracta*) K.G. 955/61, and on the south **C. christiansenianum.** Of this last there were clumps consisting of up to 35 growths, on the whole making rather dense pads".

This species is named after Dr. Willi Christiansen of Kiel in commemoration of the valuable works he has published in connection with the flora of Germany.

Drosanthemum filiforme L. Bol. sp. nov. (*Hispicaulia*).—Inter gracillima in genere; planta integra non visa; rami primarii (ut videtur) decumbentes subflexuosi, sparse hispidi vel demum glabri, ad 28 cm. longi, 1·5—2 mm. diam., internodiis 2—3 cm. longis, cortice brunneo; ramuli erecti intertexti, cum floribus ad 23 cm. longi, 0·5—1 mm. diam., internodiis ad 3·5 cm. longis; folia fere teretia, obtusa, nitente papillata, papillis rotundis, 1—1·5 cm. longa; pedunculi saepius 4—6 cm. longi; receptaculum obconicum, ad 3 mm. longum diametroque; sepala 5, 3—4 mm. longa, basi 1—1·5 mm. lata; petala 2—3-seriata, e supra medium inferne angustata, obtusa rosea, ad 1·3 cm. longa, ad 2 mm. lata; staminodia nulla; filamenta ca. 4—5-seriata, erecta lutea, ad 5 mm. longa, intima parum supra basim papillata, antheris pollineque albis; glandulae distantes; ovarium e glandulis gradatim ad 0·5 mm. elevatum; stigmata 5, sat gracilia, superne angustata, aurea, ad 4·5 mm. longa.

Cape Province: Namaqualand, Komaggas, Aug. 1961, *H. Herre*, S.U.G. 14779. Fl. Sept. 1962.

Lampranthus gydouwensis L. Bol. sp. nov.—Erectus rigidus glaber, ad 38 cm. altus, caule ad 1 cm. diam.; rami primarii atrati, internodiis 2—4 cm., vel rarius ad 6 cm., longis, 3—6 mm. diam.; ramuli hornotini crebre 4—6-foliati floriferi 6—16 cm. longi, 6—10-foliati, internodiis 1·5—4 cm. longis, ad 1·5 mm. diam.; folia basi leviter patentia, deinde fere erecta, supra plana acuta, lateribus convexis, dorso rotundato, carina ad lineam reducta, lat. visa prope apicem leviter angustata, acuta apiculata, minutissime punctata, punctis non politis, glauce viridia, saepius 2·5—3·5 cm. longa cum vagina tumidula, impresse lineata, 3—5 mm. longa, ad 3 mm. lata, ad 4 mm. diam.; flores meridiani, ad 1·8 cm. diam., 1—2-ternati, quasi corymbosi, cymis 2—3 cm., fructiferis ad 4 cm., longis, 2—3·5 cm. diam.; pedunculi cymarum 1·5—3·5 cm. longi, bracteis 1—1·5 cm. longis cum vagina 6 mm., basi 2—3 mm. diam., ultimi teretes graciles, 1—2·5 cm. longi, omnes paulo infra medium bracteati, bracteis 5—8 mm. longis; receptaculum subglobose obconicum, a pedunculo distinctum, 2—5 mm. longum, 4—6 mm. diam.; sepala 5, e prope medium superne angustata, acuta, omnia ± marginata, margine latissimo non amplo,

4—5 mm. longa, basi 2—3 mm. lata; petala 1—2-seriata, e medio inferne leviter angustata, saepius obtusa vel apice rotundata, purpureo rosea, 7—9 mm. longa, 1—2 mm. lata; staminodia ad stamina conice conferta valde appressa, paulo infra medium constricta, cum filamentis exterioribus dimidio inferiore dense ciliate papillata albaque, superne rosea, 4 mm. longa; filamenta ad 4·5 mm. longa, intima paulo supra medium papillata, antheris pollineque luteis; discus profunde divisus; ovarium gradatim, deinde prope medium abrupte, ad 1·25 mm. elevatum, lobis dorso complanatis; stigmata 5, gracilia, e basi attenuata, 3 mm. longa; capsula 6—7 mm. longa, infra obconica, supra ad 3 mm. elevata, suturis non, vel superne leviter, compressis, 6—7 mm., expansa 1 cm., diam., valvis late patentibus, demum reflexis, carinis inferne parallelis, superne divergentibus, minutissime lacerulatis, dimidium valvae attingentibus, alis amplis, apicem valvae attingentibus, dimidio superiore libero, alis tegentibus bene evolutis, tuberculo inconspicuissimo in loculis interdum viso; semina late obovata vel fere rotunda, muricata atrobrunnea, 0·75 mm. longa.

Cape Province: in dit. Ceres, Gydouw, Oct. 1939, *C. L. Leipoldt* 4801.

The following collections, in fruit, appear to be this species—*E. Esterhuysen* 12652 (Clanwilliam Div.; east spur Hondverbrand Ridge, South Cederberge, nr. Grootrivier Peak, April 1946); *H. Hall* 2218. (Ceres Div.; Karoopoort, May 1948).

Eberlanzia vanheerdei L. Bol. sp. nov.—Planta 1 visa, fera erecta compacta glabra, 14 cm. alta, 9 cm. et 14 cm. diam.; caulis apice 1 cm. diam.; rami primarii ad 7 mm., secondarii 3—4 mm., diam., internodiis albidis, inclusis vel 2—6 mm. longis; partes herbaceae tactu subvelutinae, pallide glauce virides; folia matura ascendentia, interdum subfalcata, supra visa plana vel prope apicem convexula, acuta vel obtusa, lateraliter compressa, carina subobtusa, lateribus planis vel altero leviter convexo, lat. visa inferne leviter angustata, obtusa vel oblique rotundata vel subtruncata, 2·5—3 cm. longa cum vagina 1·5 mm., medio 4—5 mm. lata, 8—10 mm. diam.; cymae ad 2·2 cm. longae, 2·5—3·5 cm. diam., 1—3-ternatae, 3—7-fl., pedunculis lateralibus in ramulis ultimis spinescentibus, vel cyma unica 1-fl., spinis lateralibus supra medium bracteolatis, axillis spinam gerentibus, spinis primariis ad 2 cm. longis, basi ad 0·75 mm. diam.; flos unicus tantum visus, submarcescens, ceteribus omnibus in fructum transeuntibus; pedunculi 1—2 mm. longi; receptaculum globose obconicum, 4 mm. longum, 6 mm. diam.; sepala 5, 4—5 mm. longa; petala obtusa rosea, ad 1 cm. longa, ad 1 mm. lata; staminodia nulla; stamina ca. 4-seriata, conferta, inferne incumbentia, deinde erecta, omnino alba, ad 5 mm. longa; ovarii lobi inconspicui, sat distantes, leviter compressi, vix ad 0·5 mm. elevati; stigmata 6 (7—8 in fructibus immaturis persistentia), gracilia viridia, 7 mm. longa; capsula anni prioris infra globose obconica, 4 mm. longa, supra late conica, ad 2·5 mm. elevata, suturis leviter compressis, 7 mm., expansa

12 mm., diam., valvis valde reflexis, anguste alatis, alis ultra medium attingentibus, carinis crassis, inferne contiguis, superne divergentibus, dimidium valvae vix attingentibus, tuberculo subreniformi albo, circa dimidium oris complente, processibus 2 in alis tegentibus prope os loculi conspicuis, tuberculum fere attingentibus; semina piriformia brunnea, 0·75 mm. longa.

Cape Province: Namaqualand; Richtersveld, "on road N. of road between Anisfontein and Sendlingsdrift", Oct. 1962, *P. van Heerde.* Bolus Herb. 27275.

Ruschia vanheerdei L. Bol. sp. nov.—Planta culta, decumbens, laxissime subintricateque ramosa—"plant rather flat on the ground, at present covering about a square yard in my garden" (*van Heerde*), glabra; rami plures visi, in genere graciles sed tamen lignosi rigidique, albidi, ad 30 cm. longi, ad 3 mm. diam., internodiis 3—5 cm. longis; ramuli ultimi floriferi erecti, cum floribus 11—14 cm. longi, prope basim 2-foliata, internodio inter folia et bracteas primarias cymae 3—6 cm. longo; folia matura ascendentia, supra superne convexula, prope apicem non, vel leviter, angustata, obtusa vel subacuta, dorso rotundata, lat. visa apice rotundata, levia, diu persistentia brunneaque, demum rubescentia, 3—4 cm. longa cum vagina vera 3·5 mm., medio 6—8 mm. lata diametroque; cyma rite 3-flora vel abortione 1—2-fl., bracteis primariis foliis simillimis, ad 3 cm. longis; pedunculi omnes prope medium bracteati, intermedii 4—8 cm. longi, laterales breviores; bracteae 1—1·8 cm. longae cum vagina ventricosa ad 1 cm., vel rarius foliiformes, ad 2·5 cm. longae cum vagina ad 7 mm.; receptaculum obconicum vel subclavatum, 6—8 mm. longum, 8—9 mm. diam.; sepala 5, exteriora ad 1·5 cm., accrescentia in fructu immaturo ad 2·2 cm., basi 5—6 mm. lata, ad 5 mm. diam., interiora superne ± subulata, late marginata, 9—10 mm. longa, basi ad 4 mm. lata; petala 3—4-seriata, exteriora parum inaequilonga, interiora pauca, e prope medium inferne leviter angustata, obtusa nivea, 9—20 mm. longa, 0·5—2 mm. lata; staminodia nulla; filamente ca. 4-seriata, conice conferta, alba, ad 6 mm. longa, intima prope medium dense papillata, antheris pollineque interdum griseo roseis vel rubre aurantiacis, demum pallidis; discus inconspicuus pentagonus, angulis rotundatis; ovarii lobi inconspicui, dorso subcomplanati, e disco gradatim ad 2 mm. elevati; stigmata 5, anguste subulata, ad 6 mm. longa cum cauda ad 1·5 mm. longa; capsulae senectae ferae, ut videtur, infra obconicae vel subclavatae, 10-costatae, 7—9 mm. longae, supra ad 4 mm. elevatae, suturis valde compressis, ad 1·3 cm., apertae 1·4 cm., diam., valvis erectis, in nullo modo expansis, carinis inferne parallelis subdistantibus, superne divergentibus, tertiam partem valvae attingentibus, tuberculo ovali, ca. 1 mm. longo, alis tegentibus sat brevibus, pagina inferiore prope marginem 2 alas ferente.

Cape Province: Namaqualand, "near the road to Port Nolloth, about 20 miles from Port Nolloth, collected about 2 years ago", *P. van Heerde.* Bolus Herb. 27273. Fl. Sept. 1962.

The presence of wing-like appendages near the margin on the lower surface of the covering wings of the loculi has not been recorded in any other species described in these "Notes".

Ruschia persistens L. Bol. sp. nov. (*Microphylla*).—Planta 1 visa, fera viva erecta, dense compacta, glabra, 7 cm. alta, 15 cm. et 16 cm. diam.; caulis apice 9 mm. diam., ibique ramos plures crebros, copiose ramulosos, 4—7 mm. diam., emittens; ramuli inferne saepissime foliis diu persistentibus (itaque nomen), formam sustentibusque vestiti, ad 10 paria infra par hornotinum visa; folia in ramulis floriferis 2, in sterilibus 4, inferiora supra visa plana, prope apicem leviter angustata, acuta, lat. visa saepe subfalcata, superne leviter ampliata, apice oblique rotundata, viridia, primum translucente punctata, cum aetate punctis minute margaritaceis, 5—6 mm. longa cum vagina 0·5 mm., ad 2 mm. lata, ad 2·5 mm. diam., superiora ad 5 mm. longa cum vagina ad 2 mm., ad 1·25 mm. diam.; pedunculi 2—4 mm., fructiferi ad 7 mm., longi, bracteis persistentibus, ad 4 mm. longis cum vagina 2 mm.; receptaculum semiglobosum, 2 mm. longum, ad 2·5 mm. diam.; sepala 5, e prope medium superne angustata, subacuta, 3—3·5 mm. longa, basi 1·5—2 mm. lata, interiora marginata; petala 2-seriata, e prope basim inferne leviter angustata, saepius obtusa, externe pallidissime, interne laete, rosea, inconspicue vittata, 5—6 mm. longa, saepius 1 mm. lata; staminodia pauca, mox recurva, staminibus aequilonga; filamenta ca. 4-seriata, conferta, inferne incurva, mox erecta, inferne pallida, superne purpureo rosea, ad 3 mm. longa, interiora parum supra basim papillata, antheris pollineque stramineis; ovarii lobi e disco erecti, approximati, obtuse compressi, ad 0·5 mm. elevati; stigmata 5, subulata, pallide viridia, demum 1·5 mm. longa, cauda subnulla; capsula 1 visa, senecta, infra obconica, 2 mm. longa, 4 mm., expansa 8 mm., diam., carinis inferne parallelis, superne divergentibus, ultra medium valvae attingentibus, breviter aristatis, tuberculo subreniformi.

Cape Province: in dit. Montagu, "on the farm Jakkalsfontein", Aug. 1962, *P. A. B. van Breda* 1750/62.

The following collections appear to be this species—*E. Esterhuysen* 3125 (Montagu Div.; Dobbelaars Kloof, May 1940, in fruit) and *E. Esterhuysen* 25880 (Ladismith Div.; Touwsberg, 3000 ft.), not in flower.

Ruschia mallesoniae (L. Bol.) L. Bol. comb. nov. *Mesembryanthemum mallesoniae* L. Bol., Ann. Bol. Herb. III:129 (1922).—The placental tubercle is among the smallest in the genus, the valves are wingless, the keels have a short aristate wing reaching the apex of the valve, the covering wings of the loculi are very short, extending about half-way to the tubercle. This species is frequent on the mountains of the Western Province where it has often been collected by Miss Esterhuysen.

Rhinephyllum vanheerdei L. Bol. sp. nov.—Planta 1 visa, fera compacta, 7 cm. alta, 12 cm. diam.; caulis apice 1·1 cm., rami primarii ad 8 mm., diam.;

ramuli ultimi 4—6-foliati, internodiis inclusis; folia fere erecta, supra visa plana, prope apicem leviter angustata, obtusa vel subacuta, matura dorso rotundata vel in novellis carina ad lineam asperam reducta, lat. visa prope apicem leviter angustata, apice rotundata, pallide glauce viridia, cum aetate subroseo tincta, tuberculis minutis, in foliis immaturis conspicuissimis, 3—6·2 cm. longa, medio 6—9 mm. lata diametroque; flores plures visi; pedunculus subcompressus 2-angulatusque, 2—2·6 cm. longus; receptaculum obconicum, 6 mm. longum, 7—8 mm. diam.; sepala 5, e parum supra basim superne angustata, acuta, 8—9 mm. longa, basi ad 4—6 mm. lata, exteriora carinata, interiora anguste rubre marginata; petala 2—3-seriata, inferne saepe vix angustata, obtusa lutea, 9—10 mm. longa, 1—1·25 mm. lata; filamenta ca. 4-seriata, alba vel pallida, ad 9 mm. longa, interiora parum supra basim papillata, antheris pollineque luteis; glandulae nectarii approximatae vel contiguae, apice rotundatae, obscure crenulatae, fere ad 2 mm. altae; ovarium concavum, medio tantum leviter elevatum, lobis inconspicuis; stigmata 5, gracilia, ad apicem papillata, viridia, 6—7 mm. longa; capsula 1 visa senecta, supra plana, suturis vix compressis.

Cape Province: Namaqualand; "E. of Stofvlei—Stofvlei of the 'Rand-se-Pad', Boesmanland", Oct. 1962, *P. van Heerde*. Bolus Herb. 27272.

The genus **Trichodiadema** may be divided roughly into 4 main groups (one of which may be subdivided), based upon vegetative characters chiefly connected with the set of the hair or bristle terminating the papillae, either on the whole surface of the leaves or concentrated at their apex.

Key to the Groups.

1. Papillae tipped with a soft hair—e.g. *T. strumosum*, *T. fergusoniae* .. STRUMOSA
1. Papillae not as above.
  2. Leaves ± conspicuously tipped with bristles.
    3. Bristles radiating to form a diadem .. .. RADIANTIA
      3a. Plants low-growing, densely compact or loosely branched, erect or decumbent—e.g. *T. densum*, *T. barbatum* .. .. BARBATA
      3a. Plants with elongated virgate branches, sometimes scrambling—e.g. *T. setuliferum*, *T. pomeridianum* .. .. .. VIRGATA
    3. Bristles erect, forming a tuft—e.g. *T. mirabile*, *T. intonsum* .. STRICTA
  2. Leaves not, or very obscurely, tipped with bristles—e.g. *T. attonsum*, *T. calvatum* .. .. ATTONSA

Trichodiadema burgeri L. Bol. sp. nov. (*Radiantia* § *Barbata*).—Plantae plures visae, ferae vivae, juveniles caespitosae, senectae laxe crasseque ramosae, 8—12 cm. altae vel ultra, ad 12 cm. diam.; radix tuberosa, demum crassa, ad 3·3 cm. diam.; rami primarii senecti ad 1·5 cm., juveniles 2—4 mm., diam.; ramuli ultimi 1—2 cm. longi, saepe 2 mm. diam., inferne reliquiis vaginantibus foliorum delapsorum vestiti, internodiis inclusis; folia dense imbricata, supra

visa plana, e basi angustata, acuta, dorso rotundata, lat. visa superne angustata, 5—12 mm. longa cum vagina submembranacea 4 mm. longa, papillis anguste ovalibus, apice tantum setiferis, setis papillis fere aequilongis, setis apicalibus radiantibus ad 14, albis, ad 3 mm. longis; pedunculi 3—4 mm., fructiferi ad 11 mm., longi, cum receptaculo et sepalis inferne dense capillaceo setiferi, setis erectis, ad 3 mm. longis; receptaculum obconicum, ad 3 mm. longum, ad 5 mm. diam.; sepala 5, superne angustata, subacuta, 4—5 mm., vel 5—6 mm., longa, basi 1·5—2 mm. lata, interiora marginata; petala 2-seriata, e supra medium inferne angustata, obtusa subrubida, ad 1·2 cm. longa, ad 1·5 mm. lata; staminodia sat pauca, stamina aequantia vel excedentia; filamenta ca. 5-seriata, conferta, mox fere erecta, prope basim leviter constricta, nivea, vix ad 5 mm. longa, exteriora inferne obscure ciliate papillata, intima parum supra basim papillata, antheris pollineque albidis; glandulae approximatae; ovarii lobi e glandulis fere erecti, obtuse compressi, apice rotundati, ad 0·5 mm. elevati; stigmata 5, subulata, ad 2 mm. longa cum cauda 0·75 mm.; capsula pallida, infra globose obconica, 4 mm. longa, supra per 2 mm. elevata, suturis acute compressis, ad 7 mm., expansa 1·2 cm., diam., tuberculo parvo bifido.

Cape Province: in dit. Oudtshoorn; "De Rust", prope Oudtshoorn, Sept. 1962, *S. Burger*. Bolus Herb. 27274.

Sphalmanthus crassus L. Bol. sp. nov.—Planta 1 visa, fera erecta glabra; radix crassa tuberosa, parte superiore tantum visa, 8 cm. longa, ad 7 cm. diam.; partes herbaceae virides, papillis orbicularibus, in vivis inconspicuis; rami hornotini herbacei, primarii ad 1 cm. diam., internodiis 2—2·5 cm. longis; folia ascendentia vel patentia, opposita vel in ramulis floriferis alterna, supra visa linearia, e supra medium leviter angustata, obtusa, leviter concava, dorso rotundata, 3·5—5·5 cm. longa; pedunculi ad 1·4 cm. longi, apice 3—4 mm. diam.; receptaculum subglobosum vel globose obconicum, 7—8 mm. longum, 8—9 mm. diam.; calycis tubus ca. 1·5 mm. longus, segmentis 5, basi 4—6 mm. latis, exteriora obtusa, 1·6—2 cm. longa, interiora in dimidio superiore acutissime subulata, ample marginata, 1—1·5 cm. longa; petala per 1 mm. coalita, in alabastris viridia, matura pallidissime citrina, marcescentia pallide rosea exteriora ca. 3-seriata, e supra medium inferne levissime angustata, obtusa, ad 1·7 cm. longa, ad 1·5 mm. lata; staminodia pluriseriata, 7—12 mm. longa, exteriora in petala gradatim transeuntia, interiora a petalis bene distincta; filamenta 6—7-seriata, pallide viridia, demum albida, ad 6 mm. longa, antheris pollineque stramineis; nectaria tubiformia, basim loculi attingentia; ovarium e nectariis gradatim ad 1·5 mm. elevatum, lobis acute compressis, dorso subconcavis; stigmata 5, viridia, obtusa, 2 mm. longa, vel in flore altero superne attenuata, ad 3 mm. longa.

Cape Province: Namaqualand; Richtersveld, "top of Kliphoogte, growing with Conophyllum", Sept. 1962, *P. van Heerde*. Bolus Herb. 27271.

ADDITIONAL NOTES

Lampranthus subrotundus L. Bol. (*L. subglobosus* L. Bol. non Haw.) was described (Mesemb. III:56) in 1937. It flowered in Nov. 1936 in the Stellenbosch University Garden, the locality and collector being unknown. Miss Esterhuysen's Collection (29791) from the "Ceres Div., Baviaansberg (north of Theron's Pass) slopes, eastern aspect, 4000 ft., Nov. 4, 1962", has been identified with this species. It represents two forms—older plants with petals up to 1·5 cm. long and plants flowering in their first year ("in a burnt area") with petals up to 1 cm. long, as in the type.

Drosanthemum worcesterense L. Bol. was known only from the type collection (Worcester Veld Reserve, Nov. 1934, *N. G. van Breda* 163) until it was found in Nov. 1961 "at the edge of a dry river bed at Karoopoort" by *H. Hall* (2291).

The range of distribution of **Delosperma ausense** L. Bol. was extended by the collection of *H. Hall* (1912) made at Lorelei in March 1960. It flowered freely at Kirstenbosch (N.B.G. 218/60) during October and November 1962.

In August 1961, Mr. Herre (S.U.G. 14646) collected a **Cheiridopsis** between Steinkopf and Eenriet which flowered in September 1962. It is undoubtedly the same as the one (Karoo Garden 192/59) noted in this Journal (27:264) as being **C. aspera** L. Bol. with larger leaves and flowers than those of the type. The collector and locality were not known.

NOTE.—The type specimens of all new species described in this paper are in the Bolus Herbarium, University of Cape Town, Rondebosch.

(*To be continued.*)

A NEW VARIETY OF EDITHCOLEA FROM TANGANYIKA

By J. J. Lavranos and D. S. Hardy

(With Plates I and II)

Edithcolea grandis N. E. Brown **var. baylissiana** Lavranos et Hardy nov. varietas, a typo caulibus quadragonis, semper procumbentibus, sparse ramosis, lobis corollae brevioribus, colore coronae exterioris differens.

Caules procumbentes, quadranguli, glabri, glaucovirides angulis versus brunnei, dentibus conicis pungentibus armati, 20 cm. (tenus 75 cm.) longi, 20 mm. crassi; flores solitarii ex apice caulium producti; bracteae solitares, aculeiformes; pedicelli ca. 18 mm. longi, 4 mm. crassi, teretes, glabri; sepala 6 mm. longa, 3 mm. lata, deltoidea, acuta, glabra; corolla rotata, 8—10 cm. diametro, extus viridis, glabra; tubus leviter urceolatus, 8 mm. longus, 7—9 mm. latus, intus flavus, basi atrosanguineus punctatus, et deinde transversus lineatus, glaber; discus prope orificium tubi rugosus, alibi asperiusculus, flavus, dense atrosanguineus maculatus, regionibus 5, ex centro radiantibus et pilis clavis, atrosanguineis, tenus 10 mm. longis instructas in 5 sectoris divisus; lobi 25 mm. longi, 28 mm. lati, ovati-deltoidei, parte apicale rubro-brunnei vel brunneo-virides, pilis clavis atrosanguineis, longis sparse induti, marginibus leviter revolutis, apice paulo reflexo; corona exterior 4 mm. diametro, cyathiformis, emarginata-dentata, flava, margine atrosanguineo, intus breve pilosa; coronae interioris lobi ca. 2 mm. longi, antheras excedentes et conniventes, basi lineares, apicem valde incrassati, flavi, apicem dorsoque tuberculis irregularibus atrosanguineis dense obtenti.

TYPE LOCALITY: Tanganyika, 2 miles north of Kihurio in the steppe between the Southern Pare Hills and the Usambara Mountains, alt. appr. 1,800 feet, Bayliss No. 74, coll. 15.1.1951 (PRE, Holotype).

Stems procumbent, sparsely branched, rooting when in contact with the soil, 20 cm. (up to 75 cm.) long and 20 mm. thick, glabrous, 4-angled, square in section, glaucous olive-green but brown along the angles which are armed with conical teeth, each bearing an obconical rudimentary leaf which soon hardens into a dark-brown, horny spine.

Flowers solitary, rarely two together, from the apical portion of young stems.

Bracts usually one only, tooth-like, rigid.

Pedicel appr. 18 mm. long, 4 mm. thick, terete, glabrous.

Sepals 6 mm. long, 3 mm. broad at base, narrowly deltoid, acute, carinate below, canaliculate above, glabrous, glaucous green.

Corolla rotate, 8—10 cm. diam., outside olive-green, glabrous, with many nerves radiating from the centre; *tube* sub-urceolate, 8 mm. long, 7—9 mm. broad, glabrous, yellow with scattered small, dark blood-red, raised spots in its lower portion, which become confluent further up and finally form continuous concentric bands towards the mouth; mouth of tube raised abruptly above the disc in a series of dark blood-red ridges separated by pale yellow concentric deprsssions; *disc* pale yellow, densely covered with dark blood-red, somewhat raised, velvety spots which become confluent towards the base of the lobes where they cease abruptly, giving way to a pure, pale yellow, curving band, glabrous except for 5 narrow bands which bear dark blood-red clavate hairs up to 10 mm. long and radiate from near the mouth of the tube to the sinuses between the lobes; *lobes* broadly ovate-deltoid, 25 mm. long, 28 mm. broad, with somewhat revolute margins and slightly reflexed apices, dark blood-red at the base, reddish-brown to brownish-green towards the apices, narrowly margined with pale yellow, covered sparsely throughout with long, clavate, dark hairs but not ciliate.

Outer corona cupular, 4 mm. in diam., emarginate-dentate, glabrous, except for a narrow arc of reddish hairs within, pale yellow, margined with dark blood-red.

Inner corona lobes ascending, exceeding the anthers and connivent above them, appr. 2 mm. long, linear at first, the apices rounded and greatly enlarged, pale yellow, the apices, backs and sides densely covered with irregular, dark blood-red, prominent tubercles.

There are very few floral differences between our variety and the typical form of *E. grandis* N.E.Br. In the *var. baylissiana* the corolla-lobes appear to be shorter and broader. The outer corona is yellow with an emarginate, dark blood-red border, while in the type it appears to be uniformly dark with bidentate, erect lobes. The inner corona-lobes of N. E. Brown's species seem to be more slender and are gibbous at their base.

Despite its wide distribution, which ranges from the southern shores of the Gulf of Aden to Tanganyika, *E. grandis* shows very little variation. In some forms the corolla-lobes are shorter than in others, while their colour ranges from dark brown to olive-green. In all the specimens which the authors had the opportunity to examine, the outer corona was dark in colour. In habit of growth, however, it is a remarkably constant species with 5-angled, shortly but profusely branching stems and a rather shrubby growth. The stem-angles are obtuse, and more often than not, they are spirally twisted.

It is mainly in this respect that the *var. baylissiana* differs from the type. The procumbent habit of its very long, sparsely branched and uniformly square

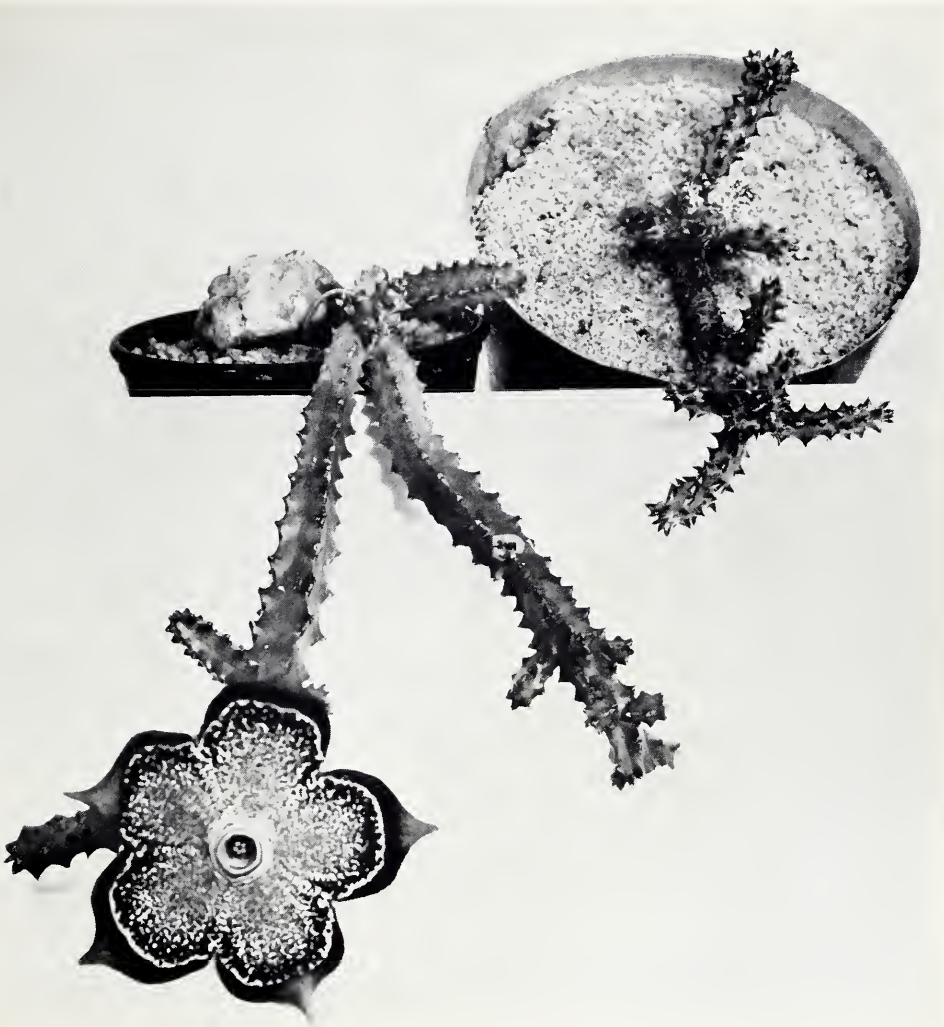


PLATE I. *Edithcolea grandis* N.E. Br. var. *baylissiana* Lavranos et Hardy, nov. var., with, on the right, a typical plant of *E. grandis* N.E. Br. appr. $\frac{3}{5}$ nat. size.

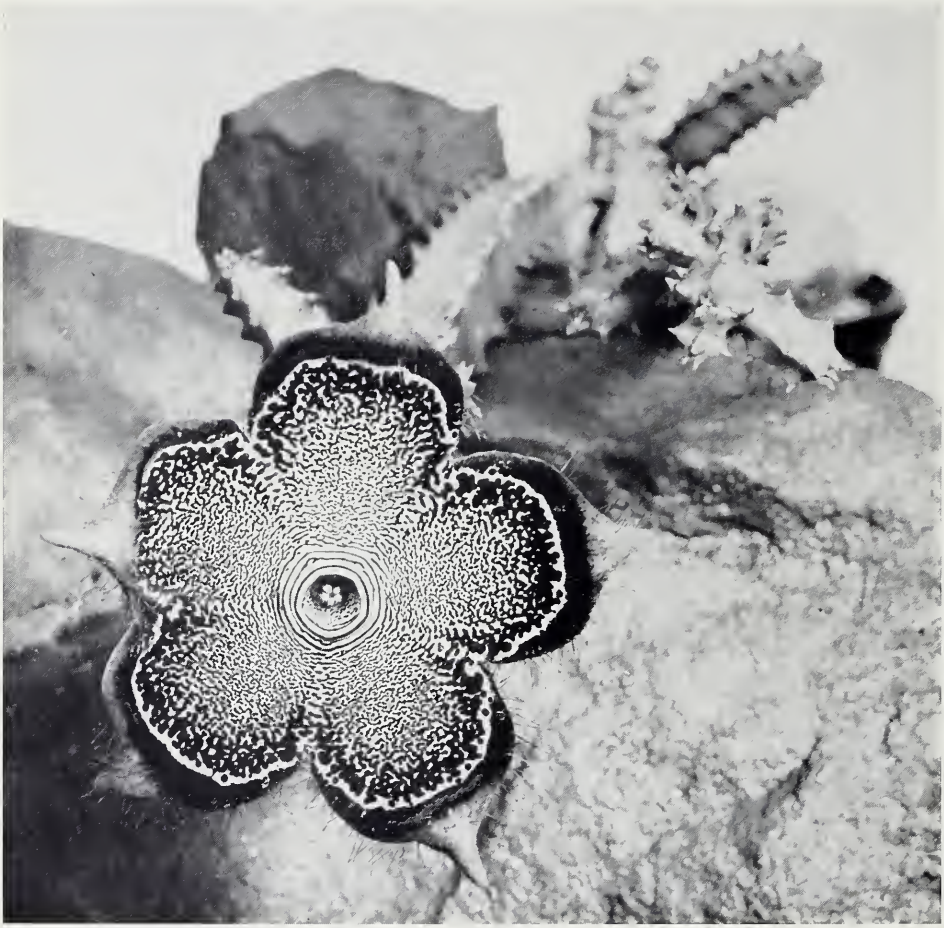


PLATE II. *Edithcolea grandis* N.E. Br. var. *baylissiana* Lavranos et Hardy, nov. var. Flower, actual size.

stems makes it hardly recognisable as an *Edithcolea* when not in flower. In the opinion of the present authors these characters, coupled with the minor floral differences cited above, constitute sufficient ground to award varietal rank to this plant.

The *var. baylissiana* was first collected by Colonel and Mrs. R. Bayliss in January, 1959, 2 miles north of Kihurio, in the dry steppe between the Southern Pare Hills and the Usambara Mountains. This area was known to the early German botanists as the "Sukkulenten Steppe". Several groups of the new variety were found growing in the shade of *Acacia zanzibarica* (S. Moore) Taub. in sandy soil in association with *Caralluma speciosa* N.E.Br., *C. priogonium* K. Schum. and other succulents.

Living plants were sent to the authors by Mrs. Bayliss and flowered in the collection of D. S. Hardy, Pretoria, in 1960 and again in March, 1962, when the present description was drawn up and the plant photographed.

The authors are indebted to Col. and Mrs. Bayliss for living plants and all information concerning the habitat of this new variety. Col. and Mrs. Bayliss have collected extensively in East Africa and it is with pleasure that the authors of the present article have decided to name this interesting variety after them.

Thanks are due to the Chief, Division of Botany, Pretoria, and his staff for the excellent photographs appearing with this article, the use of the facilities of the National Herbarium and all the help and advice which they have afforded the authors over a number of years.

The authors hereby express their thanks to Mr. P. R. O. Bally for his advice and guidance in establishing the identity of this unusual plant. Few people, if any, know the succulent plants of East Africa as well as Mr. Bally does, and the authors are, therefore, much indebted to him for his help.

HEURNIUS AND HERMANN, THE EARLIEST KNOWN PLANT COLLECTORS AT THE CAPE

By Mia C. Karsten

(With Plates III—V)

I. JUSTUS HEURNIUS

The Dutch missionary Justus Heurnius (a Latinized form of van Heurne or van Horne) is generally regarded as the first European, of whom anything beyond a mere name is known, to have collected plants in South Africa and to have sent drawings of them to Europe.

It should be remembered, however, that before Heurnius had visited the Cape, a few South African plants had found their way to Europe. One of these, and perhaps the earliest, was a dried inflorescence of *Protea neriifolia*, R. Br., which had been picked up on the shores of the Cape, and which was figured by Clusius in 1605[1], in his work *Exoticorum Libri Decem*, published in Antwerp. Moreover, de l'Obel[2] in the same year published woodcuts of two South African plants under the title "*Narcissus aphricanus bifolius*", which he had previously seen in a garden in Belgium, and whose bulbs had been sent from the neighbourhood of the Cape of Good Hope, where they had been dug up by "Guarus de Keyser" (as stated by de l'Obel), a person about whom nothing more appears to be known. There is little doubt that these drawings are meant to represent two species of *Haemanthus*, viz. *H. coccineus*, L. and *H. rotundifolius*, Gawl. The former species was later collected and figured by Heurnius (see below).

Part I of Swertius'[3] *Florilegium* (1612) contains crude pictures of five plants

[1]See G. W. Reynolds, *The Aloes of South Africa* (1950), p. 72.

[2]Matthias de l'Obel (1538-1616), after whom the genus *Lobelia* was named, was physician to William the Silent of Holland, and later botanist to James I of England. The woodcuts appeared in his paper *Rariorum aliquot Stirpium Appendix*, published in G. Rondelletii . . . *methodicam pharmaceuticam officinam animadversiones* . . . London, Purfoot, 1605. See S. Garside's account, "South African Flora", which appeared in *South Africa in Print*, published in 1952 (Van Riebeeck Tercentenary); and H. M. L. Bolus' Foreword of *Wild Flowers of the Transvaal* (1962), p. v.

[3]Emanuel Sweert or Swertius (which actually should be Sweertius) was a Dutchman, born in 1552 at Zevenbergen near Breda (Noord-Brabant), and who died in 1612. Sweert was a florist and one of the early 17th century exporters of bulbs. He sold his bulbs and plants at the yearly market at Frankfurt-am-Main (Germany), and to advertise his wares he published his *Florilegium* in 1612, the year of his death. The work is a picture-book of plants and a sale catalogue, without prices. It is printed in Latin, Dutch, German and French, and it is dedicated to his patron or protector, Emperor Rudolf II. The exotic plants depicted in Sweert's catalogue were more than likely brought to Holland on Dutch ships plying to the East and West Indies. The artist who did the plates is not mentioned: some of them are imitated from works of earlier engravers. The first edition of the *Florilegium*, printed in 1612, ran into several editions over a number of years.

The genus *Swertia* (Gentianaceae) was named in his honour by Linnaeus who must have copied the spelling with one "e" from the *Florilegium*. The only South African species, also found in the Swaziland Protectorate, is *S. stellarioides*, Ficalho

with references to the Cape of Good Hope. The plants are depicted on plates 66 and 67: they include only one flowering specimen, the remaining ones being bulbs with or without leaves. Four of them are likely to represent *Watsonia pyramidata*, (Andr.) Stapf (Iridaceae), in flower, and a *Drimia* sp. (Liliaceae), both on plate 66; *Boöphane disticha*, Herb. (Amaryllidaceae) and *Urginea altissima*, (L.f.) Baker (*Ornithogalum altissimum*, L.f.) (Liliaceae), shown in the left and right halves of plate 67. The fifth one, in the right half of plate 66 below the Drimia bulb, and looking like a rhizome, could not be identified.

Another Cape plant, collected and figured before HEURNIUS' drawings were published, is an Iridaceous plant now known as *Ferraria undulata*, L. It was the Italian botanist FERRARI[4] who published in 1633 a line-engraving of this type species of a genus which LINNAEUS rightly named after him. But in all these cases (except for "Guarus de Keyser") the actual collectors of the plants figured and described are unknown.

Returning to HEURNIUS[5], he was born at Leyden on November 17, 1587, being the sixth child of JOHANNES HEURNIUS (1543–1601), a descendant of a well-known and noble family, who was professor of medicine at Leyden University, and of CHRISTINA BEIERS.

On July 17, 1602, when only 15 years old, he was registered as a student in the faculty of medicine at Leyden University, where he received his doctor's degree on April 18, 1611. Shortly after his graduation he undertook a lengthy journey to France and England, during which he changed his mind as to his career: he wanted to become a missionary in order to work for the conversion of the "Indians". On his return to Holland he took up divinity at the University of Groningen, where he studied from December, 1615 until 1618. Soon after completion of his theological studies, when he had become a minister at the little village of Kalslagen in Holland, he wrote his "De Legatione evangelica ad Indos capessenda admonitio" (Memorandum on an evangelical mission to be undertaken to the Indies), in which he urges the authorities and governors of the Dutch East India Company to promote the Christianization of the peoples who had been brought under their rule. As a token of appreciation the "Staten-Generaal" (Dutch government) to whom he had dedicated his work, presented him with a bonus of 100 guilders. Moreover, this essay was the reason that he was called to the East Indies by the Synod of Amsterdam on November 13,

[4]GIOVANNI BATTISTA FERRARI (1584–1655). The line-engraving referred to was published in his work *Flora seu florum cultura*, Rome, 1633. A second edition appeared in 1646. From S. GARSIDE's account "South African Flora", see footnote 2.

The Iridaceous genus *Ferraria* was named after him by LINNAEUS. According to E. P. PHILLIPS, *The Genera of South African Flowering Plants* (1951), the genus comprises 22 species, natives of Africa and South America, 12 of them being found in South Africa. The type species is *F. undulata*, L., a South African plant.

[5]The following biographical records of JUSTUS HEURNIUS and of his father and brother have been taken from A. J. VAN DER AA, *Biographisch Woordenboek* [Biographical Dictionary], Vol. 6–7 (1867), pp. 228–9.–P. C. MOLHUYZEN en P. J. BLOK, *Nieuw Nederlandsch Biographisch Woordenboek* (1911–1937), pp. 230–1, 745–6, 747.

1623. Very soon after, on January 9, 1624, he sailed from Holland in the Indiaman *Gouda* and arrived at Batavia on July 17 of that year. He worked under the Dutch governors-general JAN PIETERSZ COEN, JACQUES SPECX and HENDRICK BROUWER. In 1632 he was posted by Governor SPECX, who disagreed with him on church matters, to the "Coromandel Coast"[6], but the very same year he returned to Batavia, where in the meantime SPECX had been replaced by BROUWER as G.G. In 1633 he was transferred to the island of Amboina (Moluccas), where he worked for a short time as a missionary. Thence he was sent to the Oeliassers (or Oeliasers, both spellings are used), a group of three small islands to the east of Amboina, viz. Haroekoe, Saparoea and Noesa Laoet. He did important mission work on Saparoea, in his day called Honimoa. However, in September, 1635 he had to leave the Oeliassers, having been poisoned by hostile Mohammedans, causing a paralysis of his hands and feet. The Governor recalled him to Amboina, where he worked until May 17, 1638, when he left for Batavia by way of Flores and Bali, which form part of the Lesser Sunda Islands group. On December 23, 1638 he returned to Holland, and in March, 1640 he was appointed third clergyman of the small town of Wijk bij Duurstede, but he retained his interest in mission work.

It is not exactly known when he died, but it is generally understood that his death occurred between September, 1651 and September, 1652.

The voyage to the East Indies in 1624 was to be a long and tedious one: of the 348 souls on board no less than 19 died, probably many of them of scurvy, before the *Gouda* reached Batavia. On the way to the Indies there was the usual stop at the Cape of Good Hope for taking in water and other supplies. In those days (28 years before JAN VAN RIEBEECK's arrival!) there was nothing in the way of a settlement where Cape Town now stands, not even a fort. When the *Gouda* was taking in supplies in the Bay, HEURNIUS went ashore, and undertook a little expedition to the mountain slopes, perhaps because it furnished a good view over the surrounding country. Here he collected a number of plants, among them what is now called *Stapelia variegata*, L. in flower, which by later collectors, e.g. N. S. PILLANS, was found on the northern slopes of Table Mountain and Lion's Head.

Although mission work was his chief concern, he appeared to have been interested in botany. The wonderful Cape flora must have greatly appealed to him. Of ten of the plants he collected on the Cape Peninsula, he made simple but recognisable drawings. These he sent, after he had reached the East Indies, to his brother OTTO HEURNIUS[7] at Leyden, who passed them on to JOHANNES

[6]North-south stretch of coast on the east of India.

[7]OTTO HEURNIUS (1577–1652), eldest son of JOHANNES HEURNIUS, became a doctor of medicine at Leyden University in 1601. The same year he was appointed professor extraordinary of medicine, and ten years later he received the ordinary professorship.

Bodaeus Stapelius (a Latinized form of van Stapel or à Stapel), a young doctor in Amsterdam, who had graduated at the University of Leyden in 1625. Van Stapel's life work was the preparation of an annotated edition of the botanical works of Theophrastus, which he left almost completed on his untimely death in 1636. The work was finished and published by his father, Egbert Bodaeus Stapelius, Amsterdam, 1644, under the title *Theophrasti Historia Plantarum*. Heurnius' pictures of Cape plants and also of a number of species from the East Indies, with accompanying descriptions, were included in this work: they cover pp. 333–6 and are introduced by the following note[8]: "Here we have described [actually the descriptions were by Heurnius] certain Indian plants, the drawings of which the most Reverend Father and Doctor Justus Heurnius sent from East India to his brother Otto Heurnius . . . , from whom we have received a description of them. Everyone who cultivates the study of botany, must be grateful for this to the sons of Johannes Heurnius".

There is no doubt that Heurnius himself was responsible for the descriptions, which show him as a man with a fair knowledge of botany and as a keen observer. The accurate descriptions he gives are evidently based on the plants he collected, as they give full details such as the colour of the flowers, times of flowering, etc. What Stapelius calls "Indian" plants include the Cape ones.

The plants of the Cape of Good Hope drawn and described by Heurnius are the following:

P. 333: (1) "Laurus serrata odora, promontorii bonae spei". A little branch with a few leaves; no flowers. Very likely *Myrica conifera*, Burm. (Myricaceae).

P. 334: (2) "Tulipa promontorii bonae spei". Two pictures, viz. of a flowering specimen, and of a bulb with the two prostrate leaves. *Haemanthus coccineus*, Jacq. (Amaryllidaceae). (3) "Verbena Indica lanuginosa" (Woolly Indian Verbena). This is almost certainly a Cape plant, *Manulea rubra*, L. (Scrophulariaceae). The fact that it is called an Indian plant does not necessarily imply that it came from what we now mean by India.

P. 335 (Plate II): (4) "Sedum arborescens promontorii bonae spei", *Cotyledon orbiculata*, L. (5) "Frutillaria crassa promontorii bonae spei", *Stapelia variegata*, L. (Asclepiadaceae). (6) "Iris uvaria promont. bonae spei", *Kniphofia uvaria*, (L.) Hook. (Liliaceae).

P. 336: (7) "Vtricaria". The plant depicted consisting of a bulb. two leaves and an inflorescence, is probably *Micranthus tubulosus*, N. E. Br., an Iridaceous plant, whose leaves are inflated. (8) "Nummularia mucronata promont. bon. spei", ? *Centella villosa*, L.f. (Umbelliferae). (9) "Acetosa bulbosa", *Oxalis*

[8]Original Latin text: "Hoc loco plantas quasdam Indicas describemus, quarum icones, ex India Orientali doctiss. & reverendissimus Pastor ac Medicus Iustus Heurnius, misit fratri Otthoni Heurnio . . . , à quo has describendas accepimus. Istis itaque Ioannis Heurnii filiis gratis agere de his debent, qui studium botanicum colunt".

Planta sine nomine. Hanc placet *verbenam lanuginosam Indicam* vocare, quæ his verbis ab Heurnio describitur. Folia habet oblonga, ambitu incisa, in extremo obtusè mucronata, lanuginosa, inodora, propè radicem crebriora; caulem rotundum, semicubitalem; cauli orbiculatim assurgunt flosculi parvuli, coloris obscurè phœnicei, quinque foliorum, racematim ex calyculis subluteis prorsili, inodori; radix fibrosa. Floret Aprili, id est, autumni in illis regionibus initio.

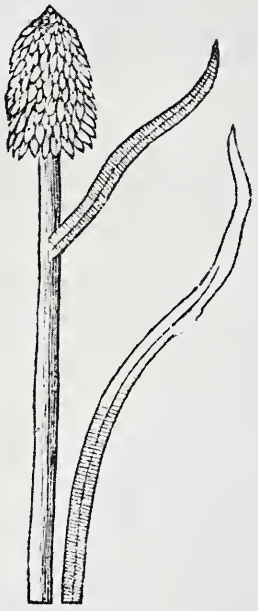
Sedum arboreſcens promontorii bonæ ſpei:

Sedum arboreſcens promontorii bonæ ſpei. Sedum arboreſcens folia digitum ferè craſſa, ex viridi albicantia habet, volæ manus fermè magnitudine.

Frutillaria craſſa promontorii bonæ ſpei,

Frutillaria craſſa (dem. illariæ ſpecies videtur) promontorii bonæ ſpei vel Soldanica à loco, foliorum loco excreſcentias habet digiti longitudine & craſſitie faccolenta, angulis rupium inſtar præruptis, circumquaque eminentibus, & in aculeum deſinentibus. Folia hæc ſummo ad livorem purpureum vergunt, infernus viridia; quibus flos adnaſcitur quinq; conſtans foliis tenuibus, in extremitatibus acuminatis; quæ corollam in medio poſitam cingunt, quæque illum attingunt lata ſunt, & orbiculato margine in acumen vergunt. Corolla proruberat, intuſque concavum habet, cui alter quaſi floſculus inſidet, conſtans quinque mucronatis foliolis in extremitatibus fuſcis, cætera luteis, ſtaminibus aliquot in centro phœniceis. Color floris externus ſordidus, purpureus eſt; intus fundus luteus maculis fuſcis undique conſpergitur, tam in foliis quam in corolla. Caulis quo flos foliis nectitur, ſtriis purpureis diſtinguitur, vix ſemidigiti longitudinem habens, folia parva appendice radici tuberoſæ, candidæ cohærent. Planta plane inodora eſt, naſcitur locis montanis arenoſis.

Iris uvaria promont. bonæ ſpei.



Iris uvaria: Florem habet coloris phœnicei, qui uvulis deorſum propendentibus, capitelli vel cunei formam habet. caulis bicubitalis, rotundus fuſci coloris; folia longa, digitum lata, utroque latere acuta glandioli forma; flos fœtidi odoris eſt. naſcitur locis paludoſis.

Veriola

PLATE IV. *Huernia campanulata*, R. Br., the type species. From a water-colour drawing by Col. R. J. GORDON. By permission of the Rijksmuseum, Amsterdam.

Fig 1.

Fig. 2.

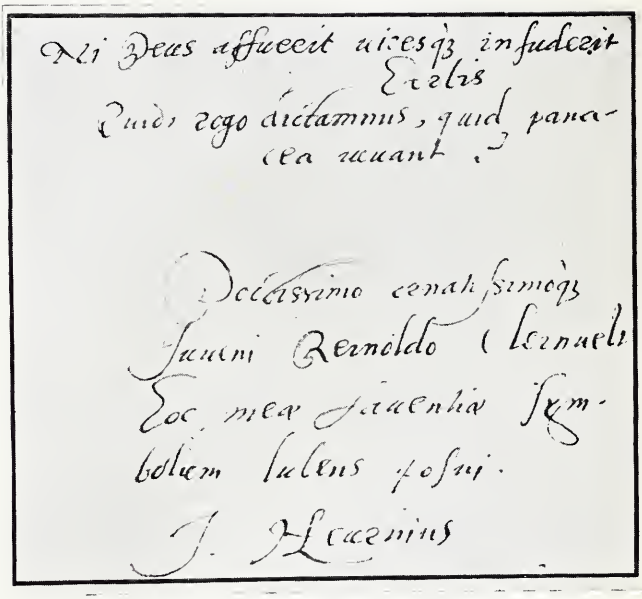


Fig. 3.

PLATE V. FIG. 1. *Huernia hystrix*, N. E. Br. Flowering specimen in the Herbarium Garden of the Botanical Survey of Swaziland, Mbabane. June, 1961. M. Karsten del.

FIG. 2. *Huernia zebrina*, N. E. Br. Flowering specimen in the Herbarium Garden of the Botanical Survey of Swaziland, Mbabane. May, 1961. M. Karsten del.

FIG. 3. Facsimile of JUSTUS HEURNIUS' handwriting. Autograph sentiment written by him in the album of a young friend. The text reads: "Nisi Deus affuerit viresque infuderit herbis, quid, rogo, dictamnus, quid panacea juvant? Doctissimo ornatissimoque Juveni, Reinoldo Clernueli, hoc meae faventiae symbolum lubens posui. J Heurnius". Translation: "Unless God be near and impart His strength to the herbs, what, I ask, will dittany, what will heal-all avail? For the very learned and gifted youth, Reinold Clernuel, I have gladly written this token of my good-will."

By permission of the Publishers of WHITE & SLOANE, *The Stapelieae* (1937).

versicolor, L. (10) "Trifolium bulbosum flore albo promont. bonae spei", *Oxalis ? purpurea*, L. var. *alba*.

Pictures of two species of plants indigenous to the East Indies are mixed with those from the Cape. On p. 333 we find what is probably a sketch of the nutmeg, *Myristica fragrans*, Houtt., a branch bearing a few leaves and two fruits, and the "nucleus cum cortice" (kernel with seed-coat) drawn separately. P. 334 shows, under the name "Langoas" a *Canna* sp. (pedicel with leaf, flowers and fruits).

In two of the old Cape floras tribute is paid to HEURNIUS as the earliest collector of Cape plants.

§ V of LINNAEUS' *Flora Capensis*, a botanical dissertation of C. H. WÄNNMAN, but written under LINNAEUS' direction, gives some short notes on early collectors at the Cape and botanists in Europe who had not visited the Cape themselves, e.g. JAN BURMAN, who worked on Cape plants. Published in Uppsala in 1759 as a little pamphlet of 19 pages only, it is known as the very first, and shortest, flora of the Cape. The list referred to starts with HEURNIUS, and what is said about him reads as follows (translated from the Latin): "The plants of the Cape have for a considerable time escaped the attention of Botanists; among the first plants here discovered must be mentioned those which Justus Heurnius, Minister and Doctor in East India, sent to his brother Otto Heurnius. . . . These were the following: *Canna*, *Kiggelaria Africana* [this may be a mistake for what appears to be *Myrica conifera*, Burm.], *Haemanthus coccineus*, *Cotyledon orbiculata*, *Stapelia variegata*, *Aloe Uvaria*, and two *Oxalis* species, which Stapelius in *Theophrastus* 1644, p. 333 produced and sketched".[10]

The author makes a mistake by stating that HEURNIUS sent *plants* to his brother. Moreover, the *Canna* is erroneously mentioned as one of the Cape plants. Three other Cape plants depicted by HEURNIUS, are omitted from this list (see above).

THUNBERG in his Flora Capensis[11] pays tribute to HEURNIUS under the

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[9]C. H. WÄNNMAN, *Flora Capensis* (1759), § V, p. 4; republished in LINNAEUS, *Amoenitates Academicae*, Vol. V, pp. 353–370 (1760), HEURNIUS p. 356.

[10]Orig. Latin text: "Plantae Capenses diutissime Botanicorum industriae sese subduxerunt; inter primas plantas hic detectas nominandae sunt, quas Justus Heurnius, Pastor & Medicus in India orientali, misit ad fratrem Ottonem Heurnium, . . . Fuerunt vero hae: CANNA . . . OXALIDES duae, quasque Stapelius in *Theophrastum* 1644, p. 333. *edidit & delineavit*".

[11]C. P. THUNBERG, *Flora Capensis* (1823 ed. Schultes). Praefatio Auctoris, p. VII. Orig. Latin text: "Botanici et Collectores, qui ipsi hocce promontorium salutarunt". HEURNIUS is the first collector mentioned, and the Latin of the above quotation reads as follows: "Numerus quidem plantarum exiguus fuit, cum brevi heic versatus excursiones suas eo tempore vix ultra viciniam montis Tabularis extendere potuisset; sed singulares hujus regionis gazae non modo rarissimae fuerunt sed summam quoque Botanicis Europaeis admirationem excitarunt".

heading "Botanists and Collectors who devoted themselves to this same Cape". Having introduced HEURNIUS as the very first person who collected plants at the Cape, he continues: "The number of these plants was scanty, since he only managed to carry out short excursions, and in the time at his disposal was scarcely able to wander beyond the neighbourhood of Table Mountain: but the unique treasures of this region were not only extremely rare, but excited the highest admiration of European Botanists".

In his *Critica Botanica*, published in 1737, LINNAEUS first proposes the generic name *Stapelia*, and two months later he wrote in the *Hortus Cliffortianus*[12]: "I have named this genus after Johannes Bodaeus à Stapel, a most painstaking commentator on the works of Theophrastus, since he was by far the earliest person who distinguished the above species".

The species referred to is the plant depicted under the name "*Frutillaria crassa*" (correct spelling Fritillaria), the flower of which being described by HEURNIUS in these words (translated from the Latin): "Within the yellow base it was everywhere sprinkled with dark spots"[13], which suggested a comparison with *Fritillaria meleagris*, L. (Liliaceae). The plant was consequently named by LINNAEUS *Stapelia variegata*. But he should have honoured HEURNIUS rather than VAN STAPEL, by naming this genus after him, the credit of the discovery of this first species of a new genus being due to him.

But a later botanist, ROBERT BROWN, paid him tribute by naming another genus of the Stapelieae after him: *Huernia*, R. Br., founded on *H. campanulata*, R. Br., the "Bell-shaped Huernia", in Memoirs of the Wernerian Society, Vol. i (1811), p. 22. The name as introduced in this publication shows an inaccuracy, viz. the spelling Huernia instead of Heurnia. In an explanatory note BROWN says: "I have named the genus in memory of JUSTUS HEURNIUS." But in the reprint in BROWN'S collected works (l.c., Vol. ii (18?), p. 206, the collector's name is printed "Huernius": it does not occur in BROWN'S MSS.[14]. According to the international nomenclature regulations this error in the spelling has to be perpetuated.

The water-colour drawings of a number of Cape plants made by Col. ROBERT JACOB GORDON[15], housed in the State Printroom which forms part of the Rijksmuseum in Amsterdam, include an excellent picture of *H. campanulata*, which is reproduced herewith (Plate IV). A comparison shows that GORDON'S

[12]LINNAEUS, *Critica Botanica*, Leyden, dated May 31, 1737; p. 13. Idem, *Hortus Cliffortianus*, July 30, 1737; p. 77, orig. Latin text: "Dixi hoc genus a Johanne Bodaeo à Stapel laboriosissimo commentatore in Theophrasti opera, cum is facile primus fuerit, qui priorem detexit speciem".

[13]Orig. Latin text: " . . . intus fundus luteus maculis fuscis undique conspergitur" (vide Pl. III, a reproduction of p. 335 of STAPELIUS' work; HEURNIUS' description of "Frutillaria crassa" in the right top corner, the above quotation lines 6 and 5 from below).

[14]JAMES BRITTEN, *Some Early Cape Botanists and Collectors*, Journ. Linn. Soc.—Botany, Vol. xlv (1920–22), p. 30.

[15]This Journal, Vol. XXVII, Jan. 1961, pp. 35–7.

drawing of this species is better than the one reproduced in MASSON's *Stapeliae Novae* (1796), under the name *Stapelia campanulata*, Mass. The species was first collected by MASSON "in dry places" as he tells us[16]. There is little doubt that the Great Karroo was referred to, for it was rediscovered about 1930 by G. J. DE WYN near Prince Albert. Later it was also found in the Ladismith and Oudtshoorn districts of the Cape[17].

H. campanulata is a most striking species with its large campanulate flowers, exquisitely marked and coloured. When expanded they are about $1\frac{1}{2}$ in. in diameter. They are produced 2 to 3 together near the base of young stems, developing in succession. The outside of the flowers is smooth, pale greenish, spotted with purple; the inside minutely papillate, bearded with stiff purple hairs at the throat of the tube, and of a whitish or pale sulphur-yellow colour, marked with blackish-purple or blackish-crimson spots, passing into transverse lines in the tube, which is entirely dark purple at the base.

Flowers quite different in appearance are produced by *H. hystrix*, N. E. Br. and *H. zebrina*, N. E. Br., which were much later discovered and found widely distributed, particularly the latter one. Both of them are among the many Asclepiadaceae which form part of the Swaziland flora. I have included in this paper drawings of these two species which have been made from specimens collected in this Territory.

Specimens of *H. hystrix*, N. E. Br., the "Porcupine Huernia" (Plate V, Fig. 1), were collected by me in the bushveld near Stegi, at an altitude of c. 1000 ft., on November 26, 1958, but they were not in flower at the time. They were planted in the little Herbarium Garden of the Botanical Survey at Mbabane, where they ultimately started flowering in December, 1960; the accompanying picture was made of a flower produced in June, 1961. The flower is just over $1\frac{1}{2}$ in. in diameter with a short tube. The inner surface of the corolla is densely covered with short spiny papillae, hence the name "Porcupine H." The colour of the corolla is ochreous-yellow to brown, marked with crimson spots on the lobes and with numerous transverse crimson lines within the smooth and paler tube, and the "spines" themselves are tipped with red. The flowers are characterized by a fish-like odour.

As to its distribution, other Swaziland localities are Ingwavuma Poort and Grand Valley in the Hlatikulu district, respectively at an altitude of 500 and 2500 ft. Further it is found in the Barberton, Pietersburg and Zoutpansberg districts of the Transvaal; in Natal, where this species was first collected, but the precise locality is unknown; in Zululand, the Orange Free State and as far as Portuguese East Africa and Matabeleland in Southern Rhodesia.[18].

[16]Ibid., p. 29.

[17]WHITE & SLOANE, *The Stapelieae*, Vol. III (1937), p. 947.

[18]The various localities of *H. hystrix* and *H. zebrina*, apart from those in Swaziland, have been taken from WHITE & SLOANE, *The Stapelieae* (1937), Vol. III, pp. 892–3, 927–8. See the same source for full descriptions of these species.

The picture of *Huernia zebrina*, N. E. Br. (Plate V, Fig. 2), the "Zebra-like Huernia" or "Life-buoy Flower", I made in May, 1961 of a flowering plant growing in the Herbarium Garden, which was originally collected by Capt. D. R. KEITH in Swaziland, but there are no records as to the locality and the date of collecting. The specimen might have been found in the Stegi district. The flowers of this species are most distinctive because of the very prominent fleshy ring or annulus around the mouth of the corolla tube. The name "Life-buoy Flower" could not have been better chosen. The flower in the picture measures $1\frac{1}{2}$ in. in diameter, which is slightly above its actual size. The tube is very shortly campanulate, constricted and about $\frac{1}{4}$ in. in diameter at the mouth, the limb[19] is slightly saucer-shaped, very abruptly spreading from the tube, raised around its mouth into a broad thick convex ring which is very shiny. The corolla lobes are deltoid, very acute and at their inner surface sulphur-yellow or pale greenish-yellow, marked with transverse purple-brown broken bands in a zebra-like pattern which pass into spots upon the smooth swollen ring.

H. zebrina was originally collected in Zululand, but the precise locality is unknown. Later on it was found at Mkusi in Zululand which might be the type locality. Other localities are in the Zoutpansberg, Potgietersrus, Pietersburg and Barberton districts of the Transvaal. Moreover the species has been reported from the Bechuanaland Protectorate, while it was collected by Prof. KURT DINTER in Great Namaqualand (South West Africa), a photograph of which was published in his work *Neue und wenig bekannte Pflanzen Deutsch Südwestafrikas* (New and little known plants of German S.W.A.), 1914. In the Swaziland veld one often comes across this interesting little Stapeliad. We collected it at an altitude of 500 ft. at Big Bend, Ingwavuma Poort and Usutu Poort in the Hlatikulu district. At Big Bend it was found growing among rocks, at Usutu Poort we spotted specimens trailing under bushes. Another Swaziland locality is at Blue Jay Ranch (500 ft. altitude) in the Stegi district.

ROBERT BROWN did well in commemorating the name of this early pioneer in the field of South African botany by this remarkable genus.

As a fifth illustration (Plate V, Fig. 3) I have included a facsimile of HEURNIUS' handwriting, taken from WHITE & SLOANE'S *Stapelieae* (Vol. III (1937), Appendix A, p. 1111, Fig. 1187).

[19]Limb: the spreading part of the corolla outside the central tube.

(*To be continued.*)

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CHROMOSOME STUDIES IN THREE SPECIES OF FELICIA WITH NOTES ON NOMENCLATURE

H. P. Riley
(*Department of Botany, University of Kentucky, Lexington, U.S.A.*)
and
M. R. Levyns

While on a visit to South Africa the first author obtained seeds of three species belonging to the tribe Astereae. On his return to Kentucky these were grown and a cytological investigation carried out. The cytological part of this paper is the outcome of these studies.†

Unfortunately in South Africa there is a considerable diversity of opinion with regard to both genera and species in the Astereae and the three species investigated reflect this uncertainty. Two of the species were obtained from the botanical garden of the Department of Botany of the University of Pretoria through the kindness of Mr. A. Berg. They were named *Aster capensis* and *Felicia bergeriana*. The third species was obtained from the National Botanic Gardens at Kirstenbosch through the kindness of Mr. H. Hall. This was named *Felicia rotundifolia*. It was soon apparent that if the cytological results were to have a real value, the names attached to the three species would have to be verified. At this point the co-operation of the second author was sought and in the present paper she is responsible for the taxonomic part.

Quite a wide range of problems present themselves in connection with the species. Aster is a Linnaean genus and most of the species described in the first edition of the Species Plantarum, belong to the northern hemisphere. Felicia was established by Cassini in the year 1818 for a group of African species allied to Aster. Harvey in the Flora Capensis kept up the genus Aster, sub-

†The cytological work was aided by grant G.13220 of the National Science Foundation, Washington, D.C., U.S.A.

dividing it into two subgenera, Felicia and Agathaea. All the species with which this paper is concerned fall under the subgenus Agathaea of Harvey. Bolus and Wolley-Dod in the Flowering Plants and Ferns of the Cape Peninsula placed all the species of both subgenera in Felicia. This is the sense in which the genus Felicia is understood by botanists working in the herbaria in Cape Town. E. P. Phillips in the second edition of the Genera of South African Plants reverted to the old treatment and regarded Felicia as a synonym of Aster. Thus a species may be placed in Aster in the Transvaal while the same species will find itself in Felicia in the Cape. Admittedly this is a most unsatisfactory state of affairs and there is no doubt that the species of the tribe Astereae are sadly in need of revision.

The second author adopted Felicia in the Flora of the Cape Peninsula largely as a matter of expediency. *Aster exilis* is a weed of cultivation on the Cape Peninsula, a most insignificant plant but one which raised a problem in nomenclature. The relationship between *Aster exilis* and the Michaelmas Daisies of our gardens is obvious but it is equally obvious that the South African species, though allied, form a distinct group. For this reason Felicia was retained for the native species and Aster applied to the northern species only.

Problems presented by the Three Species investigated

1. *Felicia amelloides* (L.) Voss

Reference Levyns 11,252 in the herbarium of the Botanical Department, University of Cape Town.

Amelloides is the correct specific epithet for the plant named *Aster capensis* in the botanic garden of the University of Pretoria. It is a low shrub, commonly found in gardens throughout South Africa and elsewhere. It has a prolonged flowering season and its blue ray florets contrasted with the yellow disc florets make it an attractive garden plant. It is generally known to nurserymen either as *Aster capensis* or *Felicia capensis*. Its home is along the coastal strip from about Hermanus to the Kei River mouth, but there are no records of it as far to the west as the Cape Peninsula. It is now clear that *amelloides* is an older specific name than *capensis* for this species. The Compton Herbarium acquired recently a set of microfiches of the Linnaean Herbarium and this has made comparison in South Africa possible whereas formerly a journey to London was necessary. There is no doubt at all that the Linnean species *Cineraria amelloides* is the present species. The synonomy is therefore, *Felicia amelloides* (L.) Voss in Vilmorin's Blumeng. ed.3, Sieb. & Voss

Aster capensis Less.Syn. Comp. 168 (1832)
Agathaea coelestis Cass.Bull.Philom. (1815)
Agathaea amelloides DC. V 225 (1836)
Cineraria amelloides L.Sp.Pl. ed.2 (1762). Mill.Icon.t.76 fig.2.

During the preparation of the Flora of the Cape Peninsula, the Linnaean Collection was not available for study owing to wartime conditions and therefore the identity of *Cineraria amelloides* could not be established. A species related to the species under discussion, occurs on the Cape Peninsula and the second author relying on Thunberg's statement in his Flora Capensis that *Cineraria amelloides* grew on Table Mountain, accepted this as true. As a result another species was mistakenly named *Felicia amelloides*. This species must now revert to the name *Felicia aethiopica*(Burm.f.) Bolus & Wolley-Dod, while the epithet *amelloides* is restored to the species typified in the Linnaean Herbarium.

2. *Felicia rotundifolia*(Thunb.) comb.nov.
Reference Compton 23,655 in the Compton Herbarium in the National Botanic Gardens, Kirstenbosch.

It is very dubious as to whether this is the correct name for this species. Harvey when he was preparing the Flora Capensis, saw Thunberg's specimen and came to the conclusion that it was merely a young plant of the species now known as *Felicia amelloides*. He named it *Aster capensis* var. *rotundifolius*. In view of the first author's cytological findings presented in this paper, it is evident that Harvey was wrong. However, there is no certainty that Thunberg's species is the same as the species now bearing this name at Kirstenbosch. A visit to Thunberg's Herbarium in Uppsala is the only way of deciding whether the present species is the same as Thunberg's. Even if it should turn out to be the same the combination *Felicia rotundifolia* is already in existence, probably for some other species. In the Index Kewensis the taxon *Felicia rotundifolia* is cited as follows: "G. C. Taylor in New Fl. & Silv.III. 118 (1931)". This work has not been seen by the authors but there is nothing to suggest that it is a new combination of Thunberg's species. Thus it is important that material of the species used in these studies be preserved so that even if the name prove to be wrong, the identity will not be in doubt. The reference given above will ensure this. Compton 23,655 was collected at Mossel River to the east of Hermanus and is an excellent match of the plant growing at Kirstenbosch under the name *Felicia rotundifolia*.

3. *Felicia bergeriana* sensu hort. non Bolus & Wolley-Dod.
Reference Scheepers 1221, in the herbarium of the Botanical Department, University of Cape Town.

Felicia bergeriana was first described by Sprengel in 1826 under the name *Cineraria bergeriana* (II). His description is meagre, he cites no specimen and merely states that it came from South Africa. Six years later a good and full description was given by Lessing (7) under the name *Elphegea bergeriana*, and he states that it is the same species as *Cineraria bergeriana* Sprengel. His

diagnosis ties down the species for he states that it is an annual, that it has sterile disc but fertile ray florets and that it was collected by Ecklon on the Lion's Rump above Cape Town. A species answering this description was until a few years ago, locally common in that area, so there is no doubt about the plant Lessing meant. Subsequently the species was transferred to Aster by Harvey and later to Felicia by Bolus and Wolley-Dod.

The material used by the first author in his cytological studies was obtained from seedlings grown from seeds given to him by Mr. Berg of the University of Pretoria under the name *Felicia bergeriana*. The second author being familiar, with *Felicia bergeriana* in its wild state, felt dubious about the correctness of the name given to the Pretoria plant. *Felicia bergeriana* is an inconspicuous annual and not likely to have any horticultural value. Thanks to the kindness of Dr. L. E. Codd and Professor H. G. Schweickerdt, material of the Pretoria plant has been made available and, as suspected, belongs to another species. Unfortunately owing to our imperfect knowledge, it is not possible at the present time to name the species. Specimens have been preserved and when in due course Felicia receives the attention it merits, the species will be named. It may well prove to be one of the little understood species with which this genus abounds and for this reason a new taxon has not been created.

Dr. Codd has attempted to trace the history of this species in the gardens of Pretoria and some interesting facts have emerged. The University of Pretoria got their original seed from the Division of Botany. Mr. Erens who was formerly head gardener at the Division of Botany, thought that seed had come from plants growing in the gardens of the Union Buildings and that their seed might, in the first instance, have come from the well known firm of Sutton in England. Novelties have in the past been introduced into European gardens by these enterprising seedsmen and it may well be that the so-called *Felicia bergeriana* cited by Darlington and Wylie (4) and the species investigated here, may be traced back to the same source. The fact that the same chromosome number is given in both cases, supports this conjecture.

Cytological Results

Materials and methods

Chromosome studies were made from the root tips of germinating seeds which had been sown in sterilized soil. When the roots were about 1—2 cm. long, the seedlings were dug up and slides were prepared from their root tips by slight modifications of the technique of Bhaduri and Ghosh (1954). The effect of this technique was to cause the chromosomes to spread out and separate from one another so that they could more easily be counted and to cause the chromosomes to shorten considerably and their chromatids to diverge so that

they frequently had the appearance of an X. At least twenty cells of each species were studied and drawn. The measurements recorded in the tables reflect the averages of these cells. Chromosomes were arranged in homologous pairs by considering together those chromosomes that were most alike with respect to the ratios of the short arm to the long arm and of the short arm to the length of the chromosome, disregarding the length of the centromere in the pair of chromosomes with a long, attenuated centromere in *F.rotundifolia*. Measurements in the two tables represent the averages of the two chromosomes of a homologous pair. Ideograms have been drawn for each species (figs. 2, 4 and 6).

Chromosomes were studied with a Leitz ortholux microscope using an oil immersion plano-apochromatic objective of 100X magnification and 1·32 N.A. and at a magnification of X 3,000. The slides were prepared by Dr. Victor J. Hoff and Mr. Debdas Mukerjee but were studied by the first author who takes full responsibility for the interpretation.

Observations

Felicia amelloides. The somatic chromosome number is 18 (Fig. 1), the average length of the individual chromosome is 4·7 μ, and the range is from 3·5 μ to 5·8 μ. If the pairs of homologous chromosomes are classified as in Delay's list of chromosome numbers wherein chromosomes less than 3 μ are regarded as short, those from 3 μ to 6 μ as intermediate and those above 6 μ as long, all chromosomes would fall in the intermediate category. This classification does not appear to be sufficiently discriminatory, so a classification based on 1 μ intervals was adopted. As can be seen from Table 1, the range of lengths covers three intervals with the majority of chromosomes in the 4·1—5·0 class. An index of relative lengths of the two chromosome arms of the homologous pairs was obtained by dividing the shorter arm of each chromosome by the longer (Table 2). The indices range from 0·39 to 0·93; the average index for the nine pairs of chromosomes is 0·68 and the median is 0·67. One pair of chromosomes has a rather marked secondary constriction (Fig. 1).

Felicia rotundifolia. The somatic chromosome number is 16 (Fig. 3). The individual chromosomes range in length from 2·2 μ to 4·0 μ and the average length is 3·5 μ. Table 1 shows that they are almost equally divided between the 2·1—3·0 and the 3·1—4·0 μ intervals. When the indices of the ratios of the short arm to the long arm are computed for the homologous pairs, they are found to range from 0·33 to 0·86 (Table 2); the average index is 0·49 and the median lies between 0·44 and 0·47. One pair of chromosomes has an elongated, attenuated centromere (Figs. 3 and 4). These centromeres appear very long in some cells, rather short in others, but generally long. Because of their length, careless observation could easily cause the short arm to be regarded as an extra

chromosome and the sporophytic number to be 18, but even when the thin connecting thread is scarcely visible, the position of the small arm to the long one usually suggests that it is not a separate chromosome. Because of the possible confusion, cells were studied independently by Dr. Hoff, Mr. Mukerjee and the first author. Each arrived at a sporophytic number of 16. In a few of the cells one chromosome appears to have a satellite on its short arm, but it is not clear. One chromosome seems to have a secondary constriction but it is not as clear as that in *F.amelloides* and may be illusory.

Felicia bergeriana sensu hort. The somatic chromosome number of this plant has been recorded as 12 (Bilquez, 1951, cited in Darlington and Wylie, 1956) and this report is confirmed by the present study (Fig. 5). The average length of the chromosomes is 2·86 μ and the range is from 2·5 to 3·3 μ. They are divided between the two intervals 2·1—3·0 μ and 3·1—4·0 μ (Table 1), but two thirds of them are in the smaller class. The indices computed by dividing the short arms by the long ones range for the homologous pairs from 0·40 to 0·88 (Table 2) with an average index of 0·63 and a median between 0·58 and 0·67. One pair of chromosomes has a clear satellite on the short arm (Figs. 5 and 6).

The average lengths of the chromosomes as well as the ratios of the long arm to the short, differ in the three species. Even though the measurements were taken from chromosomes shrunken by a-bromonaphthalene and 8-oxyquinoline, they are relatively accurate since there is no *a priori* reason to suppose that the chromosomes in the different species of one genus, respond differently to pretreating agents. The differences between the species are brought out in Tables 1 and 2. Some morphological features are not so obvious. A pronounced secondary constriction is present in one pair of chromosomes of *F.amelloides*, while in *F.rotundifolia* there is an indication of a secondary constriction in at least one chromosome, although it is not clear. *F.amelloides* does not appear to possess any satellites, one chromosome *F.rotundifolia* has a somewhat indefinite satellite, while one in *F.bergeriana* has a clear one.

The results of this investigation show that cytology may well play an important part in future studies on the Astereae in South Africa. Harvey's view that *Felicia rotundifolia* is merely a variety of *Felicia amelloides* is clearly disproved by the present research for the two taxa differ not only in their basic chromosome number but also in their chromosome morphology. Combined taxonomic and cytological research give promise of solving many of the problems which confront us in this group at the present time.

Another feature brought out in this work is the need for a preserved and numbered specimen, lodged in a recognised institution. When name changes have to be made, as they undoubtedly will in Felicia, cytological results have a permanent value if a specimen be available to which reference may be made.

At present there is no guarantee that a name given to a species by one worker is not used to denote another species by a second worker. A case in point is *Felicia amelloides*. In Darlington and Wylie's Chromosome Atlas *Felicia amelloides*, with the popular name Blue Daisy added as an aid to identification, is given as having a somatic chromosome number of 16. No authority is quoted for the species. At least three distinct taxa have masqueraded under this epithet in the past. Furthermore, blue daisies are so common in South Africa that the use of this popular name has no value. The fact that the species cited in Darlington and Wylie has a somatic chromosome number 16, makes it almost certain that the plant investigated by Sugiura was not *F. amelloides*. The number 18 given in this paper belongs to the true *F. amelloides*, as typified by *Cineraria amelloides* of Linnaeus.

Taxonomists some years ago were forced to adopt the type system in order to ensure accuracy of naming. It appears that cytologists will be forced to adopt a similar plan in order to obviate the possibility of a laborious investigation being rendered valueless because the identity of the plant studied cannot be verified.

TABLE I.

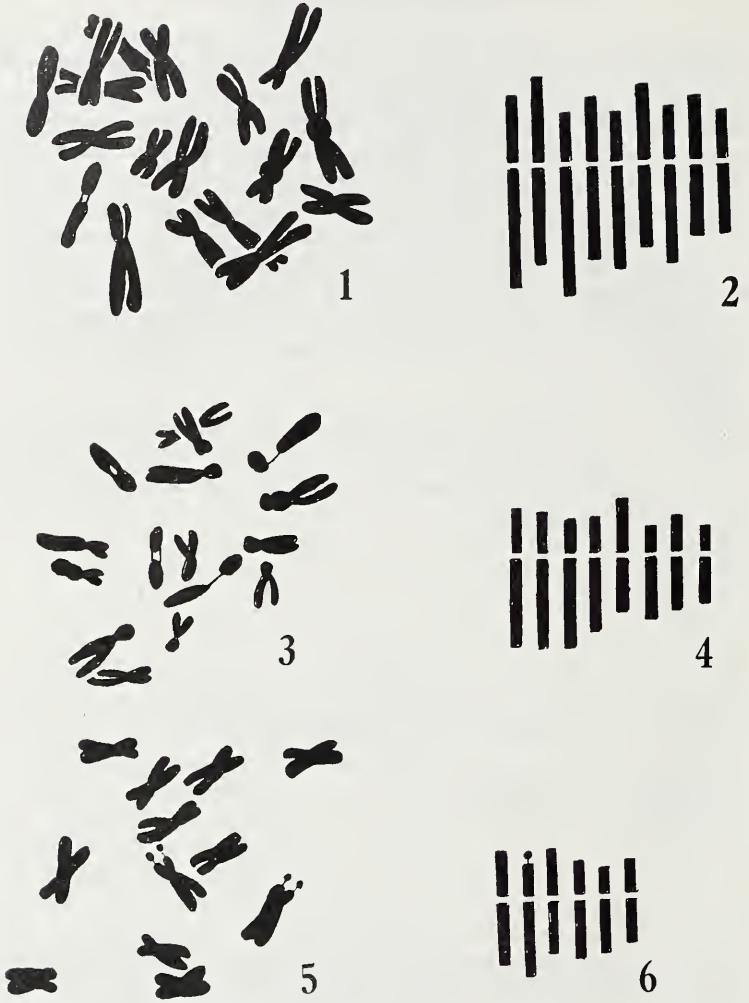
Number of somatic chromosomes of *Felicia amelloides*, *Felicia rotundifolia* and *Felicia bergeriana* classified according to their lengths.

Length in micra	*F. amelloides*	*F. rotundifolia*	*F. bergeriana*
5·1—6·0	3	0	0
4·1—5·0	5	0	0
3·1—4·0	1	5	2
2·1—3·0	0	3	4

TABLE II.

The number of somatic chromosomes in *F. amelloides*, *F. rotundifolia* and *F. bergeriana* placed in various classes distinguished by the ratios of the length of the shorter to that of the longer arm.

Ratios	*F. amelloides*	*F. rotundifolia*	*F. bergeriana*
0·90—0·99	2	0	0
0·80—0·89	1	1	1
0·70—0·79	1	0	2
0·60—0·69	1	0	0
0·50—0·59	2	1	1
0·40—0·49	1	3	2
0·30—0·39	1	3	0



KARYOTYPES IDEOGRAMS

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A NEW ALOE FROM GHANA

G. W. Reynolds

(With Plates VI and VII.)

Aloe keayi Reynolds. Species nova, affinis *A. schweinfurthii* Bak., acaule vel breviter caulescente, foliis latioribus minus recurvatis, racemis minus angustatis differt.

Planta succulenta, acaulescens vel breviter caulescens. *Folia* 20—30, dense rosulata, patentia, usque 60 cm. longa, 10—12 cm. lata, sensim attenuata; *supra* viridia, basi plana superne leviter canaliculata; *subtus* viridia, convexa; marginibus dentibus deltoideis 5—6 mm. longis, irregulariter 10—15 mm. distantibus armata.

Inflorescentia c. 1m alta, saepe 2—3-ramosa. (cult. usque 1·20 m. alta, 11-ramosa). *Racemi* subdensi, cylindrico-conici, 15—20 cm. longi, c. 9 cm. diam. *Bracteae* deltoideo-acutae, 5—7 mm. longae, 2 mm. latae, 3-nervatae. *Pedicelli* 10—12 mm. longi.

Perianthium pallide coccineum, 35 mm. longum, basi breviter stipitatum, circa ovarium 8 mm. diametro, hinc levissime constrictum et ampliatum; *segmenta exteriora* per 14 mm. libera, *interiora* libera, latiora, obtusiora. *Antherae* 2—3 mm. exsertae. *Stigma* demum 3—4 mm. exsertum. *Ovarium* viridulum 7 mm. longum, 3 mm. diametro. (Plates vi, vii.)

Hab. Ghana, Accra Plains, Nyanyana to Odupoukpeehe, near main Accra-Winneba road, fl. 5 April 1959, R. W. J. Keay et C. D. Adams, FHI 37757 (FHI); plant coll. Keay et Adams at type loc. cult Idaban (Nigeria), fl. 24 August 1962, FHI 37757 A, holotype (K), isotype (BM, PRE, EA, FHI, GC).

Our new species is named after Mr. R. W. J. Keay, until recently Director of Forest Research, Ibadan, Nigeria, who has contributed considerably to the advancement of botanical knowledge of the Nigerian flora and elsewhere.

A. keayi appears to be nearest allied to *A. schweinfurthii* Bak. which grows in the same area (and eastwards to the Congo-Sudan and Congo-Uganda borders) but differs in having little or no stem, broader less recurved leaves, racemes that are denser and less acuminate, and in the shape of the flowers.

Plants flowering on the Accra Plains in April—at the commencement of the rains—usually have 2—3-branched inflorescences about 1 m. high, whereas the same plants cultivated in Ibadan, Nigeria, flowering in September at the end of the rainy season, are considerably more robust and produce an inflorescence 120 cm. high, with up to 10 branches, the lowest of which having 1—2 branchlets.

The perianth of *A. keayi* is slightly constricted above the ovary, thence slightly enlarging, whereas in *A. schweinfurthii* it is more cylindric-trigonous. In the latter the leaves are more grey-green, narrower, and more recurved, and racemes narrow to a slender tip.

DESCRIPTION

Plant succulent, acaulescent or with very short stem, sometimes with 1—2 suckers.

Leaves 20—30, densely rosulate, the youngest suberectly spreading. up to 60 cm. long, 10—12 cm. broad at base, gradually narrowing to an acute apex; *upper surface* green, with or without a few scattered pale-green elliptic spots, flat low down, slightly canaliculate upwards; *lower surface* rounded, green, mostly without spots or markings; *margins* armed with deltoid pungent teeth 5—6 mm. long, irregularly 10—15 mm. apart.

Inflorescence usually 2—3-branched, 1 m. high, but 1·20 m. and developing 10 branches in cultivation at the end of the rains.

Peduncle green with a slight bloom.

Racemes subdensely flowered, cylindric-conic, 15—20 cm. long, about 9 cm. diam., the buds suberect, dull scarlet with dull green tips, open flowers nutant, pale scarlet to pinkish-apricot, paler at mouth.

Bracts deltoid-acute, 5—7 mm. long, 2 mm. broad at base, 3-nerved.

Pedicels the lowest arcuate-ascending, 10—12 mm. long, slightly shorter upwards.

Perianth pale apricot-scarlet to pinkish-apricot, 35 mm. long, basally obtuse and shortly stipitate, 8 mm. diam. across the ovary, very slightly constricted above the ovary thence slightly enlarging trigonously to an open mouth; *outer segments* free for 14 mm., 3-nerved to base, the nerves greenish at apex; *inner segments* broader, dorsally adnate to the outer for half their length, the upper free portion with 3 crowded nerves forming a slight keel extending to base and giving the whole perianth a somewhat striped effect.

Filaments lemon, filiform-flattened, the 3-inner narrower and lengthening before the 3 outer with their *anthers* in turn exserted 2—3 mm.

Stigma at length exserted 3—4 mm. *Ovary* light green, 7 mm. long, 3 mm. diam.

ACKNOWLEDGMENTS

I am greatly indebted to:

Mr. R. W. J. Keay for photographs, copious notes and much data concerning the Aloes found in Nigeria, for sending several Aloe plants to me, for preparing herbarium material, and for his hospitality and considerable assistance when I was investigating the Aloes in Nigeria in September 1960.

Dr. R. A. Dyer, Chief, Division of Botany, Pretoria, for photographs, and for the facilities of the National Herbarium, Pretoria.

The South African Council for Scientific and Industrial Research for travelling grants that have enabled me to investigate the Aloes of Nigeria, and elsewhere in Africa.

PLATE VI. *Aloe keayi* Reynolds.
Plant on the Accra Plains, Nyanyanu to Odupoukpeehe, near the main Accra-Winneba road, Ghana; flowering 5 April 1959, at the commencement of the rainy season. Height 1 m.
Photograph: Mr. R. W. J. Keay.

FIG. 1.

FIG. 2.

PLATE VII. *Aloe keayi* Reynolds.
FIG. 1.—Plant from Accra Plains, Ghana, cult. Ibadan, Nigeria, flowering Sept. 1960—at end of rainy season. Height 1·20 m.
FIG. 2.—Flowers 1/1 from bud to post-pollination stages.

NOTES ON MESEMBRYANTHEMUM AND ALLIED GENERA

H. M. L. Bolus

Sphalmanthus baylissii L. Bol. sp. nov. (*Eusphalmanthi*).—Plantae 2 visae, ferae erectae, ut videtur, altera inter frutices intertexta, ad 22 cm. altae; radix incrassata,* parte superiore tantum visa, 6 cm. longa, ad 2·3 cm. diam.; caulis apice ad 1·5 cm. diam.; rami primarii lignei, pro sectione rigidi, 4—8 mm. diam., secondarii etiam rigidi, ad 2 mm. diam., internodiis 1—3·5 cm. longis; ramuli ultimi steriles ad 10-foliati, floriferi 2—3-foliati; partes herbaceae inconspicue papillatae, papillis vix nitentibus, saepius rotundis; folia opposita vel in ramulis floriferis tantum alterna pauperataque, diu suberecta, supra plana, e medio superne angustata, acuta vel acuminata, dorso rotundata, lat. visa superne angustata, acuta vel obtusa, subglauce viridia, ad 1·7 cm. longa, medio ad 2·5 mm. lata diametroque, interdum persistentia demumque subspinescentia; flores diurni; pedunculi superne ampliati, 4—8 mm. longi; receptaculum obconicum vel globose obconicum, 5—6 mm. longum, ad 7 mm. diam.; calycis tubus 3—4 mm. longus, segmentis 5, e parum supra basim superne angustatis, basi 4—5 mm. latis, exterioribus acutis vel subobtusis, ad 1·4 cm. longis, interioribus superne acute longeque subulatis, late marginatis, 1—1·2 cm. longis; corolla ad 1·7 cm. longa cum tubo 3 mm. longo, segmentis 3-seriatis, apice rotundatis, salmoneis, 0·5—0·75 mm. latis; staminodia pauca, 8—12 mm. longa; filamenta ca. 9-seriata, rubre rosea, 1·5—9 mm. longa, antheris pollineque aureis; nectaria basim loculi attingentia; ovarium e nectariis gradatim ad 1·5 mm. elevatum, lobis acute compressis; stigmata 5, subgracilia, superne angustata, ad 1·75 mm. longa.

Cape Province: Namaqualand; "5 miles from Springbok on the Pofadder Rd.", Nov. 1962, *R. D. Bayliss* 920.

Conophytum ursprungianum Tisch. var. **stayneri** L. Bol. var. nov.—Caespitosum glabrum; corpuscula florentia 6—8 mm. longa, 6—7 mm. lata, 8—12 mm. diam., lateraliter visa late obconica, supra visa fere rotunda vel ovalia, glauce viridia, apice leviter convexo, conspicue diverseque punctato, punctis leviter elevatis, politis, saturate viridibus vel atro purpureis, nunc

*Mr. J. Rourke, at my request, has kindly examined the structure of this root and states that: "It consists of more or less concentric rings of xylem (the woody fibre-bearing tissue), in between which are rather broader bands of parenchyma cells which form the storage-tissue. It therefore cannot be correctly called a tuber, but rather be described as a swollen tap root modified for starch-storage by the development of soft parenchymatous tissue." This description could probably be applied to the swollen roots of many other species in this genus.

sparsis, nunc crebris, saepe approximatis vel coalescentibus lineasque breves formantibus, saepe os cingentibus; vaginae persistentes inferne papyraceae, superne subpergamentaceae, rubre brunneae, senectae atratae; flores 8 visi, diurni; pedunculus 3—6 mm. longus, prope basim bracteatus, bracteis 2—3 mm. longis, membranaceis vel nervo medio herbaceo, lobis papillatis, tubum aequantibus, sinu lato; receptaculum 1·5—2 mm. longum, ad 2 mm. diam.; calyx herbaceus, viridis, deinde rubre brunneus, 5—6 mm. longus, parte infima in corpusculo inclusa, tubo 2—4 mm. longo, segmentis 4—5, obtusis, omnibus ± marginatis, 1·5—2·5 mm. longis; corolla saepius 1·6 cm. longa, tubo pallido 6—8 mm., vel demum ad 9 mm., longo, segmentis 17—25, 3—4-seriatis, roseis, exterioribus inferne non, vel leviter, angustatis, obtusis, interioribus paucis acutis; stamina 16—23, 3—4-seriata, e prope medium tubi orientia, antheris pollineque stramineis; discus e ca. 10 segmentis subtruncatis compositus; ovarium circa marginem concavum, medio conice elevatum, altitudinem disci aequans vel leviter excedens; stylus cum stigmatibus 4 ad 3 mm. longus, stigmata aequans vel paulo brevior.

Cape Province: in dit. Ceres; Skurwekop, Koude Bokkeveld, "34 miles N. of Ceres on the Citrusdal Road, growing in vertical rock-crevices in Table Mountain sandstone," Dec. 1961, *F. J. Stayner*. Karoo Garden 990/61. Fl. Mart.–Apr. 1962.

Conophytum anomalum L. Bol. sp. nov. (*Derenbergia–Ovigera*).—Caespitosum glabrum; corpuscula lateraliter visa piriformia vel elongate piriformia, ecarinata, lateribus superne convexis, 1—2 cm. longa, prope apicem latissima, 6—9 mm. lata, ad 7—10 mm. diam., lobis 0·5—1 mm. longis, apice saepe inconspicue sordide purpureo notatis, parte pellucida inconspicua, subquadrata, per margines loborum percurrente; vagina persistens anni prioris pergamentacea, pallide brunnea, in dimidio inferiore polita costata, in superiore rugosa; flores 4 visi; pedunculi 6—9 mm. longi, bracteis 2 mm. a basi positis, valde herbaceis, obtusis ecarinatis, ad 4 mm. longis cum tubo 2·5 mm. longo; receptaculum 1·5 mm. longum, 2 mm. diam.; calyx 8—9 mm. longus, tubo ad 6 mm. longo, lobis obtusis, 1·5—2·5 mm. longis; corolla 1·7—2·4 cm. longa, tubo albo, 7—10 mm. longo, basi 1 mm., apice 2 mm., diam., segmentis 3-seriatis, inferne leviter angustatis, obtusis vel subacutis, luteis, parum inaequilongis, ad 1·25 mm. latis; filamenta ca. 6-seriata, e parum supra basim orientia, alba, antheris pollineque primum pallide luteis; discus inconspicuus, vix crenatus; ovarium conice ad 0·75 mm. elevatum, lobis sat acute compressis; stylus cum stigmatibus 8—11 mm. longus, stylus stigmata aequans vel ea excedens; stigmata 6 itaque anomala in flore cum 5 segmentis calycis.

Cape Province: Namaqualand; Kleinzee, prope Grootmist, *Bayliss* et *Hardy* 1163. Fl. Feb. 1963. N.B.G. 1040/62.

Conophytum vanzylii Lavis (*Cataphracta*) forma. A forma typica tubo corollae albo, segmentis pallidissime roseis, vel supra fere albis, infra pallidissime roseis, vel pallide salmoneis, vel roseis, vel albidis, vel pallidissime luteis.

Cape Province: Bushmanland, Pofadder, *H. A. Horn.* N.B.G. 238/62. Fl. Maio 1962.

Psilocaulon baylissii L. Bol. sp. nov.—Plantae 2 visae, ferae erectae glabrae, 13—24 cm. altae; caulis abbreviatus, ramos primarios crebros ca. 10 ferens, ad 23 cm. longis, 4—5 mm. diam., nodis constrictis, internodiis 1—25 cm. longis; ramuli saepissime alterne producti, ad 12 cm. longi, ultimi floriferi 1—3·5 cm. longi, ca. 3—10-fl.; partes herbaceae (foliis siccis tantum visis) rubide brunneae, minute punctatae, itaque subasperulae, punctis politis approximatis interdumque lineas formantibus; flores inter minimos in genere; pedunculi 1—3 mm. longi, in receptaculum gradatim transeuntes; receptaculum subobconicum, ad 2·5 mm. longum, ad 3 mm. diam; sepala 5, acuta vel acuminata, 2·5—3 mm. longa, basi 1—2 mm. lata; petala 2-seriata laxa, basi brevissime coalita, inferne non angustata, obtusa vel interiora acuta, rubre rosea, in staminodia transeuntia, 3—5 mm. longa, 0·25—0·75 mm. lata; staminodia acuminata hyalina, interdum obscure lacerulata, stamina excedentia, ad 1 mm. lata; filamenta ca. 3-seriata, alba, antheris pollineque pallide straminineis; ovarium conspicue punctatum, ad 1·25 mm. elevatum, lobis inconspicuis, obtuse compressis; stigmata 5, gracilia, superne angustata, rubra, 1·5—2 mm. longa.

Cape Province: Namaqualand; "20 miles from Grootmist on the road to Port Nolloth," Nov. 1962, *R. D. Bayliss* 988.

Psilocaulon herrei L. Bol. sp. nov.—Planta 1 visa, inter gracillimas in genere, culta, diffuse copioseque ramosa, glabra; caulis basi 5 mm. diam.; rami patentes vel erecti, primarii rigidi lignosique, superne cum ramulis tantum herbacei, ad 38 cm. longi, nodis inferioribus non constrictis, superioribus plus minusve constrictis, internodiis 1—2·5 cm. longis, 1—2 mm. diam.; ramuli alterne producti, seniores 9—15 cm. longi, internodiis ad 2 cm., vel in junioribus 2—5 mm., longis, ultimi floriferi cum floribus 2—4 cm. longi; partes herbaceae virides (an ob culturam?), levissimae; folia immatura tantum visa, erecta acuta, dorso rotundata, sicca ad 1·6 cm. longa; flores inter minimos in genere, in sole pleno expansi; pedunculi in receptaculum gradatim transeuntes, 5—10 mm. longi; receptaculum subclavatum, ad 2·5 mm. longum diametroque; sepala 5, exteriora primum superne incurvata obtusa, ad 0·5 mm. diam., demum submarcescentia, acuta vel acuminata, 4—5 mm. longa, basi 1·5—2 mm. lata, interiora acuta vel acuminata, late marginata, 3—4 mm. longa, basi 1—1·5 mm. lata; petala 2-seriata, saepe inferne ex infra medium leviter angustata, obtusa vel emarginata, purpureo rosea, basi alba, saepius ad 5 mm.

longa, 0·5—0·75 mm. lata; staminodia hyalina, obtusa vel acuta, inferne pallide rosea, apicem versus inconspicue lacerulata, petalis leviter angustiora, stamina subaequantia; filamenta 3-seriata, alba vel rosea, ad 3 mm. longa, antheris pollineque pallide luteis; ovarium ad 1·25 mm. elevatum, lobis subobtuse compressis; stigmata 5, alba, 2·5 mm. longa.

Cape Province: in dit. Vanrhynsdorp; Platbakkies, Aug. 1961, *H. Herre.* S.U.G. 14675. Fl. Dec. 1962.

Ruschia muricata L. Bol. forma.—A forma typica pedunculis exsertis, ad 5 mm. longis, partibus ceteris omnibus minoribus, petalis purpureo roseis, differt.

Cape Province: in dit. Kenhardt; Vanwyksvlei, "on the border of a salt pan," *F. J. Stayner.* Karoo Garden 741/62. Fl. Nov. 1962.

The following notes were made by Mr. Stayner, describing the manner in which these plants "adapted themselves to such a peculiar environment. In the shallow top layer of soil there were a few horizontal surface roots. The next 4—6 inches consisted of pure crumbly (high quality) gypsum through which a robust tap-root, without rootlets, penetrated. Then followed a layer of reddish subsoil upon the surface of which the rather long tuberous rootlets were spread, penetrating very little indeed. I consider they are not covered by salt water at any time."

Ruschia ebracteata L. Bol.—A portion of the type-material of this species, described in this Journal in Oct. 1962 as having 3-nate flowers, flowered again during February, producing an inflorescence consisting of 5 fully developed flowers and 2 buds, with all the peduncles ebracteate.

Delosperma waterbergense L. Bol. sp. nov.—Planta 1 visa, culta erecta glabra, 10 cm. alta; radix incrassata; partes herbaceae minute papillatae, papillis rotundatis, vix nitentibus, virides; folia ascendentia, supra visa e medio superne angustata, acuta, leviter concava vel demum plana, dorso rotundata, lat. visa superne angustata, acuta, 2·5—3·4 cm. longa cum vagina 1—2 mm. longa, medio 3—4 mm. lata diametroque; flores solitarii ebracteati meridiani, 3—4 cm. diam.; pedunculi superne ampliati, in receptaculum subclavatum, prope apicem leviter constrictum, deinde ampliatum, 4—5 mm. longum, 4—6 mm. diam., gradatim transeuntes, 6—10 mm., vel demum ad 16 mm., longi; sepala 5 vel rarissime 6, exteriora fere e basi complanato superne angustata foliiformiaque, acuta vel acuminata, 8—10 mm. longa, basi 2—3 mm. lata, interiora ample marginata, 5—8 mm. longa, 2 intima apice subulata, subula patente; petala roseo purpurea, exteriora 2—3-seriata, parum inaequilonga, saepius inferne leviter angustata, obtusa vel saepius subtruncata obscureque emarginata,

1·1—1·7 cm. longa, apice 1—1·5 mm., vel rare ad 2 mm., lata, interiora breviora pauca, intima acuta, e medio recurva, in staminodia transeuntia; staminodia petaloidea, inferne ad stamina appressa saturateque rosea, superne valde recurva pallidaque, extima stamina bene excedentia, intima ea aequantia; filamenta 5—6-seriata, exteriora inferne rosea, ad 5 mm. longa, intima prope medium dense papillata, pallida, antheris pollineque albidis; glandulae humiles subdistantes; ovarii lobi fere e glandulis erecti, subsemiglobosi, ad 0·75 mm. elevati.

Transvaal: in dit. Waterberg, Spruitkloof, Feb. 1959, *L. C. C. Liebenberg*. S.U.G. 14475. Fl. Sept. 1962. N.B.G. 884/62. Fl. Nov.–Feb. 1962–1963.

Polymita diutina (L. Bol.) L. Bol. comb. nov.—*Ruschia diutina* L. Bol. Mes. II: 356 (1932).

Octopoma calycinum (L. Bol.) L. Bol. comb. nov.—*Ruschia calycina* L. Bol. l.c. 47 (1929).

Octopoma connatum (L. Bol.) L. Bol. comb. nov.—*Ruschia connata* L. Bol. l.c. I: 139 (1928).

Octopoma subglobosum (L. Bol.) L. Bol. comb. nov.—*Ruschia subglobosa* L. Bol. l.c. 140 (1928).—Staminodia nulla.

Correction

Vol. XXVII: 55, line 31. For conica read obconica.

Note.—The type specimens of all new species described in this paper are in the Bolus Herbarium, University of Cape Town, Rondebosch.

(*To be continued.*)

NOTES ON SOUTH AFRICAN SPECIES OF ERICA

E. E. Esterhuysen
(*Bolus Herbarium, University of Cape Town*)

Since the treatment of the genus Erica by Guthrie and Bolus in the Flora Capensis (1905–9), a further 123 South African species have been described. At the same time the study of additional material has served to modify concepts of some species, and, as a complete revision of the genus is not in progress, these notes are submitted with the object of dealing with, or drawing attention to, some of the problems which have been encountered in the course of identification and other routine work in the Bolus Herbarium. It is to be expected that considerable study in the field and possibly, also, statistical analysis will be needed for the satisfactory delimitation of many species of Erica.

Species sequence numbers in the Flora Capensis are given for convenience of reference.

(68) **E. haematosiphon** G. and B. syn. (47) *E. macropus* G. and B.

With a wider range of material, the distinguishing character used in the key, as to whether the anthers are muticous (as in *E. haematosiphon*) or shortly appendiculate (as in *E. macropus*) no longer appears to be of specific value. (In the closely related species (66) *E. cruenta* Soland, the anthers are said to be muticous or aristate). *E. macropus* has page priority only, and *E. haematosiphon* is chosen as the valid name since it is based on a fuller description and more adequate material.

(68) **E. haematosiphon** G. and B. syn. *E. coralliflora* Compton in Fl. Pl. S. Afr. **14**: Pl. 551 (1934).

The types of these two species have been compared, together with additional material, and they appear to be conspecific. The range in variation of characters of *E. haematosiphon* is such that the features on which *E. coralliflora* was based, relating to pedicel length, amount of pubescence, slight dilation and constriction of throat, and squarrose set of the leaves, are included in *E. haematosiphon*. (Compton does not refer to the "minute crests" of the anthers as a distinguishing character, but these could be regarded as intermediate between *E. haematosiphon* and *E. macropus*. See paragraph above.) The appearance is suggestive of a shade form.

(74) **E. doliiformis** Salisb. (Sect. Dasyanthes) syn. *E. tenuibractea* Bolus (Sect. Ceramus) in Trans. Roy. Soc. S. Afr. **1**: 159 (1909).

The older name was overlooked.

(74) **E. doliiformis** Salisb. (Sect. Dasyanthes) and **E. phillipsii** L. Bol. (Sect. Ephebus) in Journ. Bot. **67**: 138 (1928).

The only difference to be observed between these two is that of the marked difference in corolla length. According to records to date they occupy adjacent areas of distribution (Map 1). Field investigation is needed to determine whether corolla length is, in fact, a reliable distinction in this case.

(93) **E. trichroma** Benth. (Sect. Euryloma) and **E. cincta** L. Bol. (Sect. Ephebus) in Ann. Bol. Herb. **3**: 174 (1923).

These show close affinities but, although the ovaries are stalked in both species, in *E. trichroma* the stalk is considerably longer.

(122) **E. armata** Kl. ex Benth. (Sect. Myra) syn. *E. umbrosa* H. A. Baker (Sect. Ephebus) in Journ. S.A. Bot. **37**: 267.

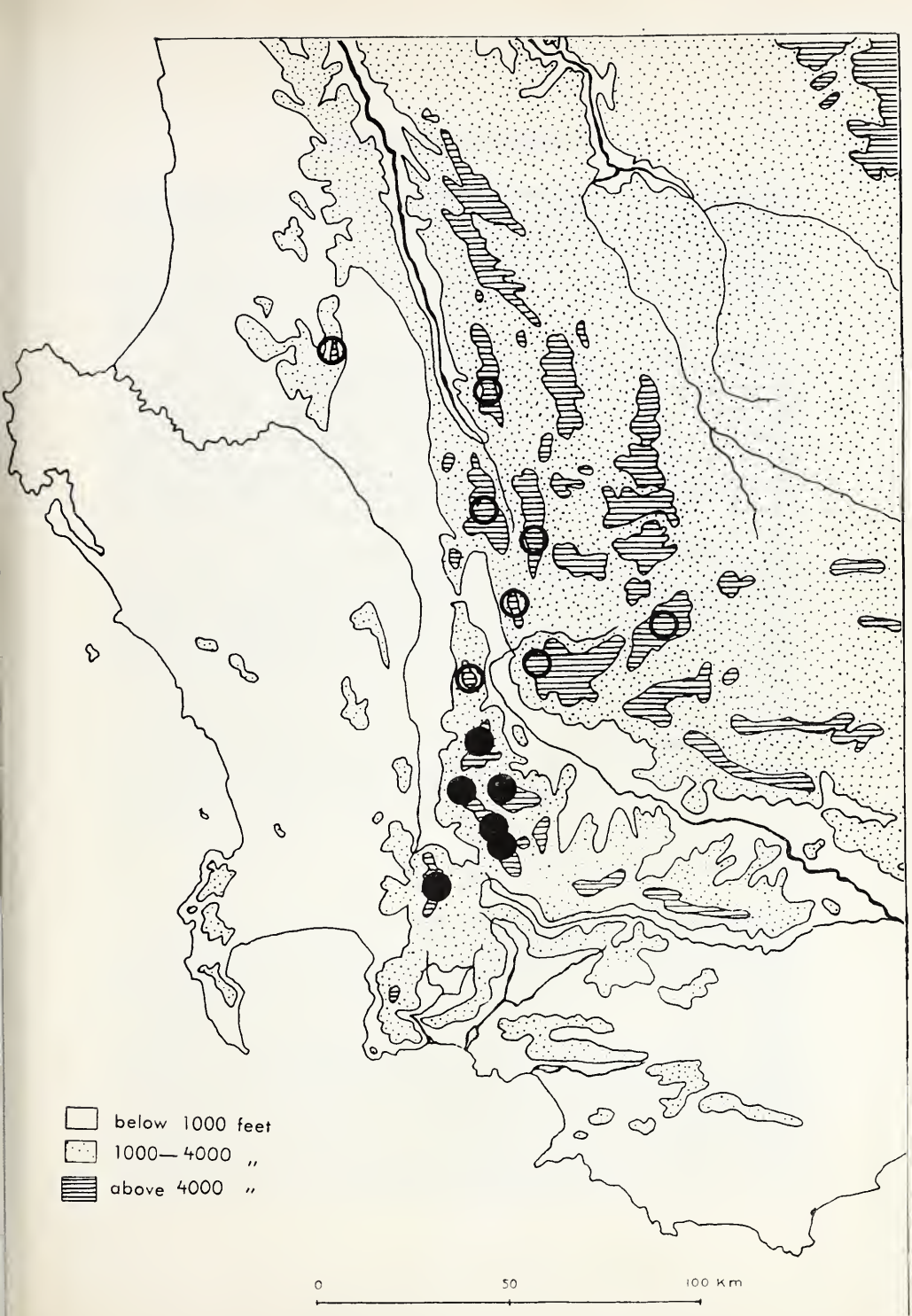
The type of *E. umbrosa* (*Oliver* 1423 BOL) agrees with the type of *E. armata* (Drege 1148), a fragment of which is in the Bolus Herbarium. Although Guthrie and Bolus placed *E. armata* in Sect. Myra, they observed that it showed affinities with *E. splendens* (*E. tumida*) and with Sect. Ephebus. The inflorescence suggests Dasyanthes.

(122) **E. armata** Kl. ex Benth. var. **breviaristata** Bolus (Sect. Myra) and (211) **E. racemosa** Thunb. var. **aristata** L. Bol. (Sect. Gypsocallis) in Ann. Bol. Herb. **4**: 132 (1928).

E. armata var. *breviaristata* is distinct from *E. armata* var. *armata* in having a velvety, not hairy, corolla and an inflorescence in which flowers are terminal and axillary towards the ends of the branches, not confined to the apex. The differences between the pair of allies appear to be: *E. armata* var. *breviaristata*—long corolla tube, anther with minute awns. *E. racemosa* var. *aristata*—short corolla tube, anther with conspicuous awns. Some near intermediates have been found, however, which have the long corolla tube but less minute awns, or the short corolla tube together with less conspicuous awns. Field study and more data will be needed to settle this question.

(197) *E. strigosa* Soland (Sect. Ceramia) differs from *E. racemosa* var. *aristata* in having a glabrous ovary, corolla not contracted towards the throat, and sepals at least half as long as the corolla. The style is not straight as described but curved as in *E. racemosa* var. *aristata*.

(160) *E. trichadenia* Bolus (Sect. Ephebus) and *E. saxatalis* L. Bolus (Sect. Orophanes) in Ann. Bol. Herb. **3**: 177 (1923) also show affinities with this group.



MAP 1.
The distribution of *E. doliiformis* (●) *and E. phillipsii* (○).

(139) **E. propendens** Andr. (Sect. Ephebus) syn. *E. dulcis* L. Bolus (Sect. Evanthe) in Ann. Bol. Herb. **2**: 154 (1918).

The earlier name was overlooked.

(145) **E. distorta** Bartl. syn. (134) *E. aemula* G. and B. var. *pubescens* G. and B.

E. distorta has been found to have 3-nate as well as 4-nate leaves on the same plant, and if the species is to include 3-nate plants, then the type of *E. aemula* var. *pubescens* (Leipoldt 613) is *E. distorta*. This does not apply to the type of *E. aemula* var. *aemula* (*Guthrie* 3109 in Bolus Herbarium, marked "Type"). Although the distinguishing character in the key, as to whether the leaves are 3-nate or 4-nate is unworkable, *E. aemula* var. *aemula* appears to be distinct from *E. distorta* in the texture of corolla and leaf surface, and may, possibly, be recognisable by its longer glabrous and shining leaves. Investigation carried out in the type locality, Gordons Bay, should help to settle the matter.

(148) **E. intervallaris** Salisb. (Sect. Ephebus) syn. *E. duthieae* L. Bolus (Sect. Orophanes) in Ann. Bol. Herb. **3**: 178 (1923).

The inclusion of plants with glabrous corollas in *E. intervallaris* appears to have been overlooked. *E. intervallaris* provides the perfect link between the two sections. It comes close to *E. parviflora* but seems to be distinct in the tetragonous shape of its corolla and in the proportionately larger corolla lobes.

(153) **E. oresigena** Bolus var. **oresigena** Bolus syn. *E. oresigena* Bolus var. *intermedia* Bolus.

The type of *E. oresigena* var. *intermedia* (*Schlechter* 10086 in Bol. Herb.), the only cited specimen, is in the fruiting state, which accounts for the difference in corolla shape. *E. oresigena* var. *oresigena*, besides, is not characterised by a constantly puberulous corolla, as implied, *Guthrie* 4259 having glabrous corollas and later collections being transitional.

(153) **E. oresigena** Bolus var. **mollipila** Bolus.

Bolus Matroosberg, cited as this, matches another sheet, *Bolus* in Herb. Guthrie 4421, same date and locality, but cited as (332) *E. maderi*, with which it agrees. The other specimen cited under *E. oresigena* var. *mollipila*, *Bodkin* 6492, is distinct, and "corolla pubescent with short and spreading segments" applies to this, not to *Bolus* Matroosberg. The "soft plumose hairs" applies to both. *E. oresigena* var. *mollipila* has not been collected on the Matroosberg, according to our records, but on the Cedarberg and Swartberg ranges, only. This is an interesting distribution pattern.

(210) **E. obtusata** Kl. ex Benth. (Sect. Desmia) and **E. oliveri** H. A. Baker (Sect. Ceramia) in Journ. S.A. Bot. **28**: 197 (1962).

The type of *E. oliveri* (*Oliver* 1555) is remarkable for its long pedicels. It differs in appearance from *E. obtusata* but, essentially, is closely linked to, and possibly a variety or form only of, this species. Members of Sect. Desmia are unusual in having a tendency to develop several or more modified scale-like or "bract-like" leaves just below the inflorescence and elsewhere on otherwise normally leafy stems.

(213) **E. petraea** Benth. syn. *E. krigeae* Compton in Journ. S.A. Bot. **1**: 37 (1935).

Krige in Herb. Bol. 13422 (the type of *E. krigeae*) has been compared with *Masson* 66 (the type of *E. petraea*), a fragment of which is in the Bolus Herbarium, together with additional material, and the two appear to be conspecific. In the type description the anthers of *E. petraea* are said to be "breviter aristatis muticisve", not only "very shortly aristulate", as stated in Fl. Cap., and our fragment of the type has anthers either aristulate or muticous. Compton was correct in not referring to the muticous anthers as a distinction between *E. petraea* and *E. krigeae*, but the characters he did use have not proved reliable. The supposed geographical separation is no longer valid since material which matches *E. krigeae* has been collected in the proximity of the "Alpine dry stony places, Camenasieland" (i.e. Kamanassie Mts.) of the type of *E. petraea*.

(215) **E. fucata** Kl. ex Benth. (Sect. Gypsocallis) syn. *E. tenuipedicellata* Compton (Sect. Chlorocodon) in Journ. S.A. Bot. **19**: 130 (1953).

The type of *E. tenuipedicellata* (Compton 18170 (NBG)) agrees with *Zeyher* 3341, fragments of which are in the Bolus Herbarium. It may not agree with *Bolus* 6739, but this should perhaps be excluded as possibly distinct from *E. fucata*.

(225) **E. bicolor** Thunb. (Sect. Pyronium) syn. (327) *E. copiosa* Wendl. var. *longicauda* Bolus (Sect. Arsace).

The type of *E. copiosa* var. *longicauda* (*Bodkin* 8678 (BOL)) has been compared with the type description of *E. bicolor* and with specimens referred to this by Guthrie and Bolus, and appears to be that species. *E. copiosa*, a widespread variable species, is in need of more detailed study.

(230a) **E. recta** Bolus (Sect. Pyronium) Fl. Cap. p. 1126 and **E. muirii** L. Bolus (Sect. Leptodendron) in Ann. Bol. Herb. **1**: 76 (1914).

These may prove to be synonymous. There is a slight difference between the anthers of the two types, that of *E. muirii* (Muir 1061) having the awn very shortly connate with the filament, while that of *E. recta* (*Marloth* 8993) is free. In other respects there seems to be no specific difference.

(246) **E. lateralis** Willd. (Sect. Orophanes) syn. (304) *E. haemantha* Bolus (Sect. Hermes).

The older name was overlooked. *E. haemantha* was treated as a member of Sect. Hermes by Guthrie and Bolus because of the presence of supposedly axillary flowers besides the terminal ones in *Bolus* 5344, the type and only representative. These axillary flowers could be regarded, however, as terminal on reduced flowering shoots. This was the view taken of the inflorescence of *E. lateralis*, described in Fl. Cap. as "sometimes pseudo-racemose" and in the type description as "floribus terminalibus et axillaribus".

(246) **E. lateralis** Willd. syn. *E. montana* L. Bol. in Ann. Bol. Herb. **3**: 177 (1923).

The type of *E. montana* (*Stokoe* s.n. in Bolus Herbarium 15940) has been compared with the type description of *E. lateralis* and with material referred to it by Guthrie and Bolus, together with additional material and the two appear to be conspecific.

(277) **E. nubigena** Bolus in Journ. Bot. **32**: 236 (1894) syn. (271) *E. macra* G. and B. in Fl. Cap.

The type of *E. macra* (*Bolus* in Herb. Guthrie 3948) is part of an old twiggy, less vigorous plant with smaller flowers than the cited specimens of *E. nubigena*. A note on the sheet indicates that Bolus compared *E. macra* with *E. mucosa*, whereas he compared *E. nubigena* with *E. physodes* and *E. ardens*, thus overlooking the true affinity. The two are separated in the key on the shape of anther crest, but these are given in the descriptions as "lanceolate at the base tapering to a long fine point" for *E. macra* and "subulate-acuminate from a broadish base" for *E. nubigena*, which are virtually identical.

(290) **E. carduifolia** Salisb. syn. *E. draconis* L. Bolus in Ann. Bol. Herb. **4**: 130 (1928).

E. draconis was compared with *E. nubigena*: hence the true affinity was overlooked.

(297) **E. regerminans** L. syn. (305) *E. pulvinata* G. and B. var. *montana* G. and B.

The type of *E. pulvinata* var. *montana* (Burchell 7111 (BOL)) has a short pseudo-raceme, unlike the usual long one of *E. regerminans*, but agrees with it in essential characters.

In the key to Hermes a distinguishing character is used as to whether the anthers are "broadish-aristate" or "narrow-crested", which is not very clear, and the descriptions are not explanatory as *E. regerminans* is described as having anthers "crested-aristate" while *E. pulvinata* has "broad-aristate" ones. *E. pulvinata* is very distinct from *E. regerminans*, however, and may be recognised on the leaf and sepal characters, used in the key.

(301) **E. parilis** Salisb. (Sect. Hermes) syn. (20) *E. longisepala* G. and B. (Sect. Pleurocallis).

The type of *E. longisepala* (*Mader* in Cape Govt. Herb.) matches *Leipoldt* 616, referred to *E. parilis*, and agrees with the type description of *E. parilis*.

(333) **E. sphaerocephala** Wendl. ex Benth. syn. (337) *E. oxysepala* G. and B. var. *pubescens* G. and B.

E. oxysepala is distinguished from *E. sphaerocephala* in the key on its 3-nate instead of 4-nate leaves. It has been found, however, on close examination of specimens cited in Fl. Cap. that the leaves are not constantly 4-nate in *E. sphaerocephala* but may be irregular or 3-nate. (This irregular arrangement of leaves was noted for *E. maderi*, a very close species). If, therefore, *E. sphaerocephala* is to include 3-nate plants then *Schlechter* 10157 (the type of *E. oxysepala* var. *pubescens*) is *E. sphaerocephala*.

E. oxysepala var. *oxysepala* may be distinguished from both *E. sphaerocephala* and *E. maderi* by the absence of plumose hairs, the different shape of its "gland-ciliate" sepals and by its glabrous setaceous-acuminate leaves. It appears to be restricted to the Tulbagh Div. In the Gothenburg Herbarium a *Schlechter* sheet labelled "Elim XII 11896" matches our sheet of *Schlechter* 7495, and we suggest that "Elim XII" may be an error.

(334) **E. solandra** Andr.

The only record from Natal is *Schlechter* 6938, van Reenens Pass, which is not *E. solandra* but is *E. reenensis* Zahlbr. in Ann. Naturhist. Hofmus Wien 20: 37 (1905). The species appear to be very close, but more adequate material is needed for comparison.

In the key to Pseuderemia, *E. reenensis* should be substituted for *E. solandra* under "corolla glabrous", and on p. 229, line 11 of the description of *E. solandra* the words "or glabrous" deleted. This serves to distinguish the two, on our present material. Besides the absence of gland-tipped hairs in these two species, noted by Verdoorn (1954), there is also an absence of the plumose hairs which are a feature of *E. cooperi* and *E. baurii* from Natal and E. Prov.

(403) **E. nobilis** G. and B. syn. *E. haroldiana* Skan, in Curt. Bot. Mag. 8835 (1920).

The sepals of *E. nobilis* vary in width and also, to some extent, in length relative to length of corolla. It must be taken into account that *E. haroldiana* was based on a greenhouse plant.

(421) **E. depressa** L. syn. *E. cremnophila* Esterhuysen and Salter in Journ. S.A. Bot. **6**: 1 (1940).

Salter (1950) refers to *E. cremnophila* as "probably a more dwarf habitat form" of *E. depressa*. There is no doubt, though, that they are sun and shade forms of the same species. The characters used by the authors of *E. cremnophila* to distinguish it from *E. depressa*, "the smaller size of all its parts, smaller and narrower leaves, colour of the more broadly campanulate corolla, and proportionately broader and shorter anthers" are differences in degree and hardly effect separation at specific level. The colour of the corolla is "rosy pink on the side facing the light and almost white on the other side". Finally the anthers are stated to be oblique at the base, but this was an insignificant difference, and proved to be unreliable.

(427) **E. fimbriata** Andr. (Sect. Trigemma) syn. (358) *E. physantha* Benth. var. *aristulata* Bolus (Sect. Geissostegia) Fl. Cap. 1127.

Bolus recognised, subsequently, that the two were synonymous. A note in his register states, "Distributed as physantha afterwards corrected". Sets were distributed to "K. Berl. Schltr. Galpin".

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PAPER CHROMATOGRAPHIC STUDIES IN THE ALOINEAE

I. PRELIMINARY OBSERVATIONS ON SOME SPECIES OF HAWORTHIA

H. P. Riley and C. J. Isbell*

(*Department of Botany, University of Kentucky, Lexington, Kentucky, U.S.A.*)

ABSTRACT

One-dimensional paper chromatograms were prepared from several species and varieties of the Coarctatae Section of *Haworthia*, and fluorescent spots were studied. Identical patterns were obtained from *H. greenii* forma *bakerii* and two clones of *H. greenii* forma *pseudocoarctata*. The pattern of *H. fulva* was close to but not identical with those of the two varieties of *H. greenii* and was the same as that of *H. coarctatoides* except that it contained one more spot. *H. baccata* had a pattern that differed greatly from the others. Identical patterns were found for *H. reinwardtii* var. *committeensis*, var. *tenuis*, and possibly for var. *diminuta*. *H. reinwardtii* vars. *chalwinii* and *haworthii* were very similar, but vars. *archibaldiae* and *valida* differed from one another and from the other varieties. The possible importance of this method to taxonomy is discussed.

INTRODUCTION

Classical methods of plant taxonomy, utilising morphological characters and especially the structure of the flowers, have been employed by botanists for several centuries and have always been accepted as the basic methods of identifying and classifying plants. In more recent years, several other methods have been developed that provide other types of information that do not supplant but that can frequently supplement the classical ones. Studies of chromosome structure and number and the biosystematic correlation of the techniques of cytology, ecology, and plant geography have been useful adjuncts to morphological methods and have upon some occasions furnished valuable information on several difficult taxonomic problems. Recently, relationships among various plants and animals have been studied by a comparison of some of their chemical compounds as shown by paper chromatography. This method has now been applied to a fairly large number of different organisms and the early results have been encouraging. Whether it will ultimately prove of con-

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siderable importance can not be stated clearly as yet, but preliminary reports indicate that a more extensive trial upon a larger number of plants and animals is justified.

Review of the Literature

Some of the early work on paper chromatography as applied to taxonomy was carried out on *Drosophila melanogaster*. Hadorn and Mitchell (1951) mashed whole boiled pupae or adults on filter paper, used the one-dimensional descending method and a solvent consisting of two parts of n-propanol and one part of 1% ammonia, and analysed the tracks for fluorescent and ninhydrin-positive substances. Buzzati-Traverso (1953a, 1953b) showed that strains of *Drosophila melanogaster* of different genotypes give constant and distinctive patterns and that by chromatography heterozygotes can readily be distinguished from either parental homozygous strain even though no phenotypic difference can be observed between the heterozygote and the homozygous dominant. He cautioned that R_f values are not highly accurate because the spots are large and the location of the solvent front is, necessarily, somewhat arbitrary.

In *Drosophila melanogaster* Fox (1956) was able to identify the spots chemically and to show that the presence of a peptide differentiated males from females. He pointed out that the one-dimensional method should be followed by the two-dimensional method, as the latter may reveal spots that do not appear with the former.

Buzzati-Traverso and Rechnitzer (1958) studied the fluorescent and ninhydrin-positive patterns from muscles, liver, and the lens of the eye of different species of fish. The patterns derived from the muscles showed differences that were constant and easily recognizable and the patterns were remarkably constant irrespective of the size and age of the fish. An important relationship was shown by the various species, for the closer the taxonomic position of any two or more species, the greater was the similarity of their chromatographic patterns. The authors stated, "This technique will become a useful tool in taxonomic and population-genetical studies."

Because of differences in paper chromatography, the syringaldehyde/vanillin values, the Maule tests, the HCl/methanol reaction, and manganese and iron content, Towers and Gibbs (1953) suggested that the *negundo* group of the genus *Acer* should be separated from the other species as the genus *Negundo*.

Selle (1954) applied paper chromatography to a study of the "quick decline" virus infection of orange trees. The sweet orange is grafted on the rootstock of some other variety of citrus fruit and its tolerance to the virus varies with the rootstock. The disease is usually fatal only if the rootstock is from the sour

orange, *Citrus aurantium*. Chromatograms were made from the bark of various types of rootstocks budded with valencias or navel oranges. If the rootstock was from the sour orange, a yellow, fluorescent, flame-like spot with an R_f value of approximately 0·50 was present, but if it was from another species of citrus trees, this spot was missing. By this method it is possible to determine which trees in an orchard are growing on a sour orange rootstock and therefore are susceptible to the infection.

Micks (1954) used paper chromatography to study mosquitoes, as many taxonomic problems in the group are not susceptible of analysis by the usual methods. Different chromatographic patterns of the free amino acids were obtained for different genera, and in the *pipiens* complex the patterns of the various species were similar but the intensities of the spots were strikingly different. This difference in intensity indicates, apparently, that there are differences in the concentrations of the amino acids. Micks states, "it appears from the results thus far obtained that paper chromatography may be an extremely useful taxonomic tool, particularly when there are no good morphological recognition characters for the species involved."

Kirk et al. (1954) studied chromatographic patterns from the posterior or lateral edges of the foot of *Theba pisana*, *Helix aspersa*, *Bothriembryon indutus*, *B. kingii*, *B. dux*, *B. leeuwinensis*, and *Austrosuccinia contenta*, all land snails from Australia. Each species was easily distinguished by its ultra-violet absorption and fluorescence patterns. Specimens of the same species from geographical localities as much as 300 miles apart showed no differences and the patterns are uninfluenced by a wide range of environmental conditions or by age. Kirk et al. suggested that with further refinement and greater ability to identify and measure quantitatively some of the spots in the patterns, it might be possible to evaluate degrees of relationship between closely related species.

In 1957, Robertson used paper chromatography to study taxonomy in the Coleoptera, Lepidoptera, Diptera, and Hymenoptera. Apparently interspecific differences can be detected but there did not appear to be definite enough criteria to distinguish the various orders of insects.

In mangoes, the fruit is ordinarily important in classification, but it would be highly desirable if vegetative parts could be used, since many mangoes bear fruit only in alternate years and it is sometimes desirable to identify young trees before they reach the bearing age. Teas et al. (1959) studied twenty-one varieties; seven gave chromatographic patterns that were entirely different from every other one and the other fourteen fell into four groups of from two to five varieties each. Teas and his co-workers feel that this method holds some promise in a programme for the identification of varietal differences. Some of the individuals that give the same patterns with the particular technique used might show different patterns with other sprays and other solvents.

In the American genus *Baptisia*, Turner and Alston (1959a, 1959b) demonstrated that distinctive profiles could be obtained from *B. laevicaulis* and *B. viridis*. Hydrolysed and unhydrolysed extracts of petals were applied to the paper by streaking and were developed by descending and ascending methods. Several solvents were used and it was shown that, in a hybrid swarm, recombination of specific biochemical compounds peculiar to each parental type occurs. Birdsong, Alston, and Turner (1960) used paper chromatography to demonstrate the amino acid canavanine in seeds of members of the Leguminosae, the only family in which it occurs, and Tschiersch (1959) reported the synthesis of this compound in the South African Leguminous genus *Canavalia*.

Some work has been carried out recently on South African members of the Iridaceae (Riley and Bryant, 1959, 1961). Twenty different major fluorescent spots were distinguished. The fundamental pattern was the same for six species of *Watsonia* but no two species had exactly the same pattern; the tracks of the six species of *Watsonia* show much greater similarity to one another than to those of *Dietes grandiflora*, *Babiana bainesii*, and *Sparaxis aureum*.

Studies in the Dipterocarpaceae by Bate-Smith and Whitmore (1959) covered twenty-eight species from several genera and especially from *Shorea*, the largest genus of the family. The presence or absence of certain phenolic constituents was used as a basis for specific differentiation, and the differences were enough to be the basis for the identification of each species.

Paper chromatography was recently applied to a study of species and subspecies of *Populus* (Börtitz, 1962). The expressed sap of the leaves was treated with several solvent systems and the fluorescent patterns were observed without identification of the separated compounds. The various species and subspecies differ more or less in quantity, position, colour, and intensity of the fluorescent spots or "zones". The closer the relationships between the taxa that were studied, the more alike were the chromatographic patterns. The age of the tree is of no importance and leaves from the top and from the middle of a twig gave the same pattern. Börtitz considers that his results of "chemical taxonomy" are similar to the natural system.

In the present paper, observations on some species and varieties of the Coarctatae Section of the genus *Haworthia* are presented. In April, 1961, they were read at a meeting of the Association of Southwestern Biologists (Isbell and Riley, 1961), and in September, 1962, a report on some species of the Rigidae and Retusae Sections was presented to the International Conference on Taxonomic Biochemistry, Physiology, and Serology (Riley and Hopkins, 1962).

The taxa studied along with the writer's voucher numbers and the numbers of the International Succulent Institute from which the plants were received are:

H. baccata—58132—ISI-B0301
H. coarctatoides—58142—ISI-C2301
H. fulva—58130—ISI-F2901
H. greenii forma *bakerii*—58139—ISI-G3202
H. greenii forma *pseudocoarctata*
clone 6—58136—ISI-G3406
clone 12—58135—ISI-G3412
H. reinwardtii var. *archibaldiae*—5879—ISI-R0805
valida—5878—ISI-2601
committeensis—58119—ISI-R1201
tenuis—58115—ISI-R4801
diininuta—5875—ISI-R5001
aff. *chalwinii*—58122—ISI-R1124
haworthii—58126—ISI-R1611

Material and Method

Seven varieties of *Haworthia reinwardti* and four other species of the Coarctatae Section were studied. They had been received from the International Succulent Institute at Millbrae, California, through the courtesy of Mr. J. W. Dodson, who obtained them from South African botanists. They were grown in pots in a mixture of fine white sand (capable of passing through a 30-mesh screen) and peat moss to which had been added commercial fertilizer according to the practice recommended by the University of California Agricultural Experiment Station Extension Service (Baker 1957). The use of a uniform method of culture reduced greatly the possibility that some spots of some species or varieties might be the result of the conditions under which the plants were grown.

Sheets of Whatman No. 1 chromatographic paper about 55 cm. long were cut lengthwise into two pieces about 235 mm. wide. A line was drawn about 75 mm. from the top and four smears of leaf tissue were made along this line at intervals of 5 cm. Each smear included both mesophyll and epidermis, was pressed into the paper by the rounded end of a test tube, and formed a spot approximately 10—15 mm. in diameter. The spots were allowed to dry at least 24 hours but could be kept for two or three days without apparently undergoing any change.

The solvent system was prepared by putting into a separatory funnel 160 ml. n-butanol, 200 ml. distilled water, and 40 ml. glacial acetic acid in that order; the mixture was shaken 2 min. and set aside for 1 hr. to separate. The lower phase of the mixture was then placed in a tray at the bottom of the chamber of a chromatographic cabinet ("chromatocab"); the chromatograms were hung in the solvent trays, the chromatocab was sealed, and the chromatograms were allowed to equilibrate with the lower phase for at least one hour. After the time had expired, the upper phase of the solvent mixture was added to the solvent trays and the solvent front was allowed to descend until it was about 25 mm. from the lower edge of the paper. This process normally required 22—24 hours. When the solvent front had descended to the required level, the chromatocab

was opened and the chromatograms were removed and dried 24 hours in the air. The above steps were carried out in a room that maintained a constant temperature of 27°±1°C.

After the chromatograms had dried in the air, they were placed in an oven at 101°C and kept there 72 hours; this step is important as it intensifies the fluorescent tracks. After three or four days in the oven, the chromatograms were placed under a twin-tube Black-ray BLB-15 ultraviolet lamp with main emission in the 3660 Å range. The spots were outlined in pencil whilst the chromatogram was under the ultraviolet lamp and the solvent front was marked; the colours of the spots were recorded on the chromatograms at this time. The R_f values were then computed for each spot of each track and represent the linear distance from the centre of the spot to the original line divided by the distance from the original line to the solvent front. To determine the consistency of the results, two sheets of four tracks each were prepared for each plant. Each of the eight tracks was made from a different leaf.

Observations

When the chromatograms were observed under ultra-violet light, fluorescent spots immediately appeared which varied in number from five to ten. Most of them were blue, but some were pink. It soon became obvious that in each species or variety the spots formed a definite chromatographic pattern or "biochemical profile" that was characteristic of the taxon. Three problems then arose. Do leaves from all parts of the plant produce the same pattern? Are the patterns of different plants of the same species or variety the same? Does a given plant produce identical patterns at different times? If any of these questions is answered in the negative, the method is utterly worthless for a taxonomic study.

To answer the first question, eight leaves were tested on each plant. Four leaves were smeared on a chromatographic sheet and two sheets were run for each plant. The patterns of all eight leaves of any given plant were identical and the R_f values varied but little. The eight patterns were so uniform that it seems unnecessary to illustrate them in all the taxa, but figure 1 shows the patterns of all eight leaves of *H. greenii* forma *bakerii* and of *H. reinwardtii* var. aff. *chalwinii* by way of illustration. As stated previously, the piece of tissue that was smeared always included part of the mesophyll and the leaf epidermis. The latter was too thin to use alone and when the former was used alone, few fluorescent spots appeared.

The second question was difficult to answer because usually only one plant of a species or variety was available. Fortunately, two different clones of *H. greenii* forma *pseudocoarctata* could be tested and they produced identical profiles (Fig. 2) thus supporting an affirmative answer to the question.

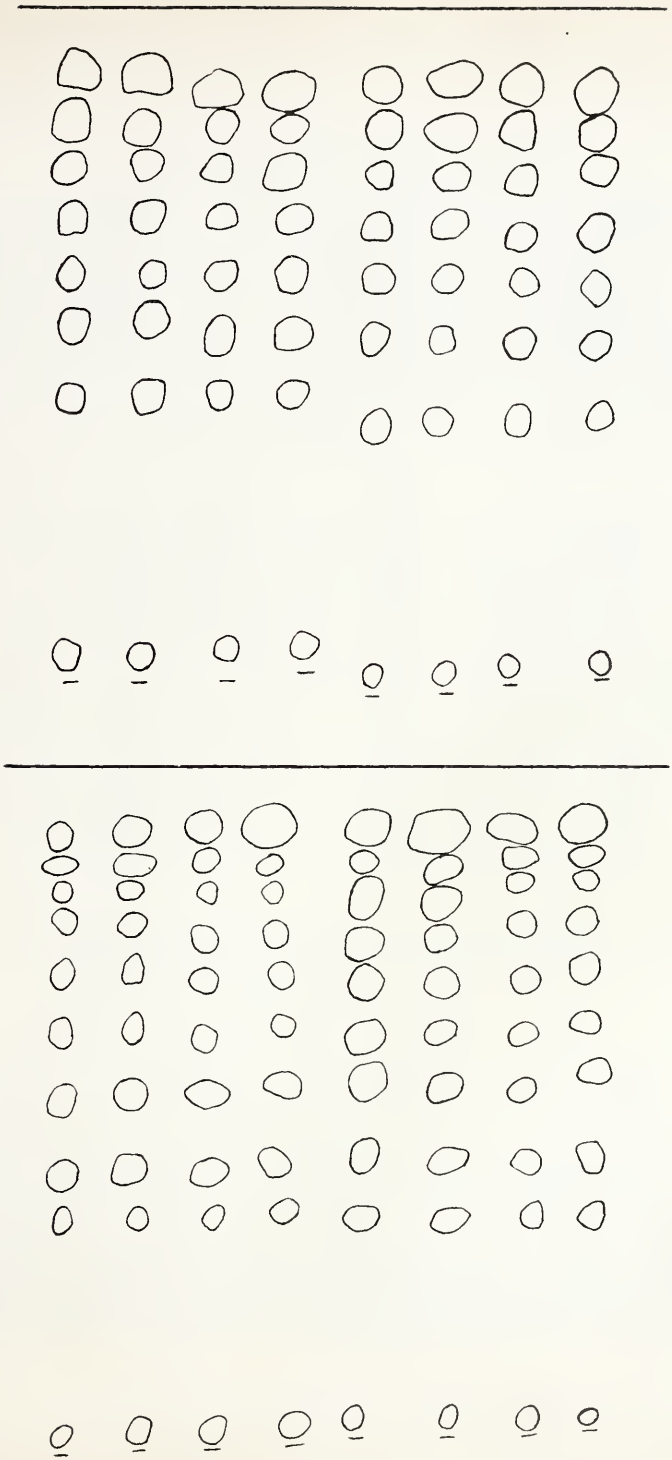

FIG. 1.—Chromatographic patterns of eight leaves of *Haworthia greenii* forma *bakerii* (above) and of *H. reinwardtii* var. aff. *chalwinii* (below). (Slightly reduced).

Three plants were used to test the third question. Chromatograms were run for *H. fulva*, *H. reinwardtii* var. *archibaldiae*, and *H. reinwardtii* var. *haworthii*. Each was tested in the Autumn of 1959 and again approximately six months later in May, 1960 (Fig. 3). Since the two series of patterns were indistinguishable for each species, it seems obvious that they are constant features of a plant, at least over a period of six months. This point is important because, in general, fluorescent compounds are less stable than some other kinds that could be studied and some investigators on other genera have found them to be too

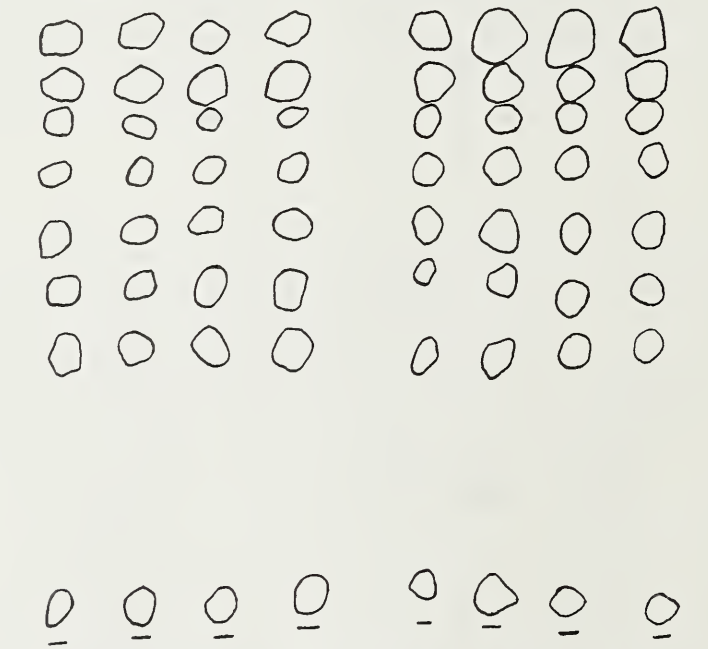

FIG. 2.—Chromatographic patterns of four leaves each of *Haworthia greenii* forma *pseudocoarctata*, Clone No. 6 (left) and Clone. N. 12 (right). (Slightly reduced).

evanescent to be reliable for a critical study. The absence of differences in *Haworthia* over a six-months period may result from the fact that it is a very slow-growing genus and that therefore these compounds are much more stable than they are in more rapidly-growing plants of a non-succulent nature.

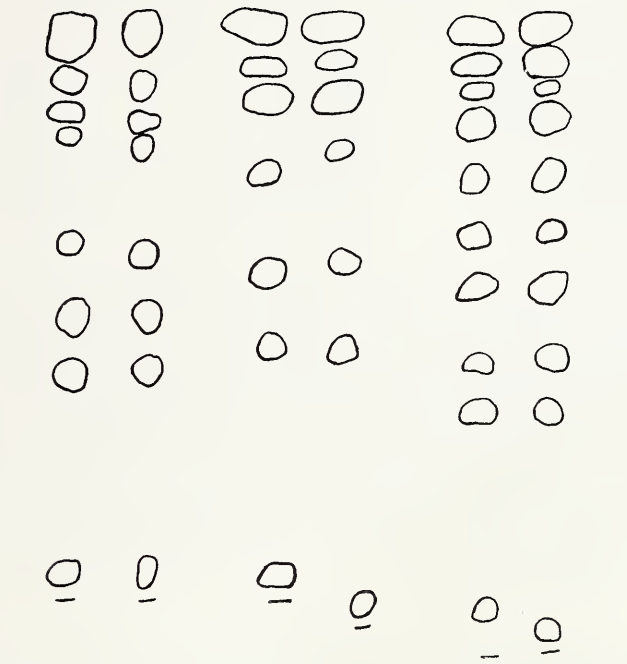

FIG. 3.—Chromatographic patterns of typical leaves of *Haworthia fulva* (left), *H. reinwardtii* var. *archibaldiae* (centre) and *H. reinwardtii* var. *haworthii* (right); the left-hand track of each pair was made in the Autumn of 1959 and the right-hand track in the Spring of 1960. (Slightly reduced).

To facilitate a comparison of the various species and varieties, an attempt was made to distinguish each spot on the basis of R_f value and colour; thus, twenty-seven spots have been recognised and are listed in Table 1. All are invisible in ordinary light and the colours that have been observed under the ultra-violet lamp are light blue, medium blue, dark blue, bright blue, and pink; the R_f values range from 0·075 to 0·682. In addition to these spots, one other is present that is green in ordinary light and red in ultra-violet light; it moves rapidly down the paper, is just at or behind the solvent front, and has an R_f value of around 0·95. This is a spot of chlorophyll and, since it is present in the same position in each taxon, has been omitted from any consideration. The other twenty-seven spots are somewhat arbitrary since it has not yet been

TABLE I.

The twenty-seven spots recognised in the *Haworthia* species studied with their R_f values and colours.

No.	Rf *Value*	*Colour*	*No.*	Rf *Value*	*Colour*	*No.*	Rf *Value*	*Colour*
1	·075—·124	BB	10	·234—·241	MB	19	·467—·493	P
2	·082—·102	LB	11	·234—·275	P	20	·477—·511	BB
3	·112—·123	MB	12	·264—·321	LB	21	·513—·533	BB
4	·129—·186	DB	13	·269—·329	MB	22	·543—·567	LB
5	·148—·164	P	14	·340—·356	MB	23	·550—·596	MB
6	·166—·215	P	15	·348—·393	P	24	·564—·597	BB
7	·201—·216	LB	16	·378—·410	MB	25	·577—·614	MB
8	·207—·248	P	17	·411—·455	LB	26	·606—·629	BB
9	·223—·272	BB	18	·413—·492	MB	27	·611—·682	MB

BB = bright blue; LB = light blue; MB = medium blue; DB = dark blue; P = pink.

possible to determine their chemical nature and since there is some overlapping of R_f values. That R_f values are considerably variable has been pointed out by Buzzati-Traverso (1953b), and it is possible that in one or two instances two or three spots are really one, and that perhaps some spots are actually two or three. Thus, spots 5, 6, 8, and 11 may all represent one compound since they are all pink, since the ranges of 5 and 6 almost touch, and since there is some overlapping between 6 and 8 and between 8 and 11, but if they are one compound they cover a very much larger range of R_f values (0·148 to 0·275) than do most spots; until a chemical analysis can be made, they will be regarded as four spots. When an identification of the spots can be made chemically, many problems such as this may be resolved.

TABLE 2

The spots (numbered according to Table 1) found in various species, forms and varieties of *Haworthia* with their mean R_f values; each mean R_f value is the average of the R_f values from eight tracks.

baccata	*coarctatoides*	*fulva*	*greenii* forma *bakerii*	*greenii* forma *clone* 6	*pseudocoarctata clone* 12
2—·092	1—·099	1—·111	1—·112	1—·112	1—·112
7—·209	6—·181	6—·187	6—·180	6—·199	6—·180
17—·436	9—·250	9—·242	11—·245	11—·238	11—·239
22—·557	18—·436	12—·291	13—·318	13—·312	13—·314
	23—·565	18—·452	16—·399	16—·401	16—·396
	27—·641	23—·574	19—·483	19—·481	19—·482
		27—·661	25—·592	25—·580	25—·600

			H. reinwardtii var.			
archibaldiae	*valida*	*committeensis*	*tenuis*	*diminuta*	*chalwinii*	*haworthii*
1—·093	1—·106	1—·096	1—·103	1—·090	1—·092	1—·078
4—·175	6—·181	4—·143	4—·157	4—·140	4—·139	3—·116
8—·235	10—·237	8—·224	8—·223	6—·203	6—·177	5—·154
13—·327	13—·314	11—·267	11—·264	11—·255	8—·231	8—·210
18—·481	16—·391	14—·346	14—·348	13—·311	13—·303	13—·284
25—·593	20—·487	18—·416	18—·427	16—·397	15—·389	15—·363
	25—·587	21—·517	21—·526	20—·493	18—·469	18—·439
		26—·610	26—·624	24—·580	23—·578	23—·558
					27—·655	27—·654

On the basis of these twenty-seven different spots, certain similarities between different taxa are readily discernible (Table 2 and Fig. 4). *Haworthia baccata* has only four spots (in addition to chlorophyll) and differs radically from all the other species and varieties. In addition, a light blue spot (no. 2) replaces the bright blue spot (no. 1) found near the original line in all the other taxa, but it is possible that this is a quantitative rather than a qualitative difference. Also, this species contains no pink spot, whereas all the other taxa that have been studied do (nos. 6, 8, 11). *H. coarctatoides* has six spots. Its pattern is almost identical with that of *H. fulva* but it lacks light blue spot no. 12. It is closer on this basis to *H. fulva* than it is to any other taxon. *H. fulva* and the forms of *H. greenii* have seven spots each, but, with the exception of the first two spots (nos. 1 and 6), they are all different. These differences are probably real ones with the possible exception of nos. 16 and 18 and nos. 25 and 27. At least, the differences are great enough to assume that *H. fulva* is closer to *H. coarctatoides* than it is to *H. greenii*. It has been pointed out that clones 6 and 12 of *H. greenii* forma *pseudocoarctata* have identical biochemical profiles and it is interesting to note that the patterns of *H. greenii* forma *bakerii*, and H. *greenii* forma *pseudocoarctata* are identical, which resemblance probably indicates that this method is better for differentiating species than varieties of the same species. In Figure 4, only typical tracks of each taxon have been portrayed to avoid too much redundancy.

Seven varieties of *H. reinwardtii* have been studied and the relationships on the basis of chromatographic patterns are interesting. *H. reinwardtii* var. *archibaldiae* is clearly distinct from the other varieties as it has only six spots. *H. reinwardtii* var. *valida*, with seven spots, is also different from the other varieties. Two varieties, *committeensis* and *tenuis*, have identical chromatographic patterns and on this basis appear to be closely related. They have eight spots, as does also *H. reinwardtii* var. *diminuta*. These three varieties have a number of spots in common and their differences may result from a misunderstanding of the nature of the spots. Thus, if spots 6 and 8 are really one, and if spots 13 and 14, spots 16 and 18, spots 20 and 21, and spots 24 and 26 are actually the same, these three varieties have identical patterns. The members of each of these pairs of spots are of the same colour but have R_f values that, with the exception of 6 and 8, do not overlap. It is quite possible that these chromatographic patterns indicate that varieties *committeensis*, *diminuta*, and *tenuis* are closely related. *H. reinwardtii* var. *chalwinii* and *H. reinwardtii* var. *haworthii* are also very similar to one another. Each has nine spots and seven of them are identical. Furthermore, it is possible that spots no. 5 and 6 are actually the same; if so, there is only one clear-cut difference between the two varieties and they must be closely related.

Fig. 4.—Chromatographic patterns of typical leaves of *Haworthia* taxa. From left to right, they are from: *H. baccata*; *H. coarctatoides*; *H. fulva*; *H. greenii* forma *bakerii*; *H. greenii* forma *pseudocoarctata* Clone 6; *H. greenii* forma *pseudocoarctata* Clone 12; and *H. reinwardtii* vars. *archibaldiae*, *valida*, *commiteensis*, *tenuis*, *diminuta*, *chalwinii*, and *haworthii*. (Slightly reduced).

TABLE 3

R_f values and colours of all the spots of each of the eight leaves that were studied for each taxon.

Haworthia baccata

·082	·086	·090	·082	·095	·093	·102	·102	LB
·209	·202	·205	·201	·213	·211	·216	·215	LB
·432	·432	·426	·411	·455	·438	·452	·445	LB
·543	·560	·558	·560	·557	·552	·560	·567	LB
·957	·958	·960	·959	·965	·957	·960	·956	R

Haworthia coarctatoides

·099	·101	·103	·099	·089	·093	·096	·108	BB
·190	·189	·194	·183	·166	·171	·172	·185	P
·272	·267	·266	·269	·228	·231	·230	·235	BB
·442	·442	·441	·452	·421	·424	·428	·435	MB
·570	·576	·581	·578	·557	·551	·554	·550	MB
·681	·675	·670	·651	·617	·611	·612	·612	MB
·967	·962	·960	·966	·955	·950	·955	·955	R

Haworthia fulva

·095	·110	·104	·107	·113	·119	·124	·119	BB
·181	·181	·173	·179	·187	·203	·200	·194	P
·225	·231	·230	·230	·264	·259	·250	·244	BB
·264	·273	·272	·268	·321	·309	·315	·307	LB
·425	·441	·438	·429	·436	·477	·484	·488	MB
·568	·566	·555	·569	·558	·590	·595	·589	MB
·652	·648	·650	·658	·648	·676	·671	·682	MB
·958	·958	·951	·960	·950	·962	·966	·962	R

Haworthia greenii forma *bakerii*

·112	·114	·110	·118	·093	·110	·124	·124	BB
·182	·186	·188	·186	·166	·172	·179	·185	P
·245	·253	·249	·245	·239	·234	·244	·257	P
·322	·320	·327	·327	·309	·310	·312	·316	MB
·398	·396	·398	·404	·394	·397	·398	·404	MB
·486	·486	·486	·490	·467	·469	·493	·486	P
·614	·602	·602	·598	·578	·577	·579	·587	MB
·971	·969	·959	·955	·959	·967	·962	·952	R

H. greenii forma *pseudocoarctata* Clone No. 6

·120	·120	·120	·116	·104	·096	·118	·102	BB
·192	·200	·192	·191	·176	·177	·179	·187	P
·241	·241	·243	·242	·228	·240	·232	·234	P
·312	·312	·316	·312	·308	·311	·313	·313	MB
·404	·404	·408	·403	·404	·397	·387	·400	MB
·473	·478	·480	·479	·478	·472	·487	·500	P
·582	·601	·573	·572	·580	·576	·571	·585	MB
·969	·967	·967	·965	·942	·950	·956	·955	R

H. greenii forma *pseudocoarctata* Clone No. 12

·098	·120	·108	·118	·111	·115	·114	·114	BB
·171	·185	·177	·176	·181	·185	·184	·179	P
·238	·245	·240	·243	·236	·238	·235	·234	P
·308	·311	·310	·322	·321	·317	·316	·310	MB
·379	·392	·382	·390	·400	·411	·409	·407	MB
·475	·462	·480	·490	·472	·489	·500	·485	P
·610	·608	·600	·602	·596	·600	·594	·589	MB
·950	·944	·945	·947	·945	·949	·949	·949	R

H. reinwardtii var. *archibaldiae*

·082	·091	·091	·091	·099	·096	·098	·093	BB
·186	·186	·186	·181	·168	·168	·166	·163	DB
·243	·238	·238	·234	·224	·224	·244	·237	P
·329	·327	·327	·325	·327	·327	·327	·327	MB
·475	·475	·473	·470	·484	·491	·492	·488	MB
·580	·578	·578	·576	·610	·610	·609	·609	MB
·956	·958	·958	·958	·969	·971	·971	·973	R

H. reinwardtii var. *valida*

·108	·107	·107	·107	·106	·106	·106	·106	BB
·180	·180	·182	·181	·181	·183	·182	·184	P
·240	·235	·239	·238	·234	·238	·237	·241	MB
·312	·311	·311	·310	·319	·318	·318	·319	MB
·398	·397	·398	·397	·387	·386	·386	·385	MB
·495	·493	·492	·493	·479	·482	·481	·484	BB
·585	·590	·589	·587	·587	·586	·585	·590	MB
·967	·967	·965	·965	·988	·977	·977	·975	R

H. reinwardtii var. *committeensis*

·096	·095	·095	·094	·095	·099	·099	·100	BB
·150	·149	·147	·146	·140	·139	·139	·139	DB
·239	·240	·238	·235	·211	·210	·214	·207	P
·267	·268	·267	·263	·269	·268	·268	·267	P
·350	·349	·345	·340	·348	·348	·347	·342	MB
·419	·417	·413	·415	·419	·414	·420	·415	MB
·517	·515	·522	·517	·516	·517	·520	·513	BB
·611	·615	·608	·606	·613	·610	·612	·609	BB
·942	·940	·937	·935	·946	·948	·946	·947	R

H. reinwardtii var. *tenuis*

·097	·099	·096	·094	·111	·111	·110	·108	BB
·161	·165	·160	·160	·151	·150	·155	·155	DB
·221	·225	·220	·219	·228	·228	·223	·222	P
·264	·268	·272	·263	·275	·274	·265	·264	P
·356	·356	·350	·349	·346	·345	·344	·344	MB
·432	·431	·423	·422	·426	·427	·428	·427	MB
·533	·532	·530	·530	·523	·522	·521	·520	BB
·621	·622	·620	·619	·632	·626	·629	·628	BB
·961	·963	·963	·961	·960	·960	·960	·960	R

H. reinwardtii var. *diminuta*

·086	·086	·092	·085	·095	·097	·095	·090	BB
·135	·132	·131	·129	·148	·150	·149	·149	DB
·200	·200	·198	·196	·207	·209	·206	·208	P
·263	·263	·263	·263	·249	·251	·246	·249	P
·307	·307	·306	·306	·317	·316	·316	·319	MB
·379	·378	·398	·392	·410	·409	·408	·408	MB
·474	·477	·477	·481	·570	·511	·509	·511	BB
·564	·565	·567	·573	·592	·593	·592	·599	BB
·960	·958	·956	·956	·958	·955	·956	·956	R

H. reinwardtii var. aff. *chalwinii*

·090	·090	·089	·085	·098	·098	·096	·096	BB
·134	·141	·134	·132	·143	·143	·143	·143	DB
·181	·181	·169	·169	·178	·178	·182	·182	P
·248	·248	·224	·224	·225	·225	·230	·230	P
·310	·310	·307	·297	·301	·301	·301	·301	MB
·387	·387	·390	·382	·391	·389	·393	·393	P
·458	·458	·465	·453	·481	·481	·481	·477	MB
·562	·562	·565	·561	·596	·596	·596	·594	MB
·654	·654	·650	·650	·660	·660	·660	·657	MB
·949	·951	·949	·949	·975	·975	·975	·975	R

H. reinwardtii var. *haworthii*

·082	·082	·082	·080	·074	·079	·075	·075	BB
·112	·123	·123	·112	·115	·117	·115	·115	MB
·155	·164	·164	·155	·151	·151	·148	·148	P
·215	·215	·211	·211	·211	·211	·206	·206	P
·301	·301	·301	·284	·277	·277	·269	·269	MB
·378	·378	·378	·378	·355	·355	·348	·348	P
·462	·462	·462	·450	·415	·428	·421	·419	MB
·562	·562	·562	·552	·570	·570	·558	·558	MB
·658	·658	·650	·650	·664	·662	·648	·648	MB
·935	·935	·930	·933	·966	·966	·944	·942	R

In Table 3 are listed the R_f values and colours of all eight spots of each of the species and varieties that were studied.

As in some of the earlier studies by various investigators, this method of paper chromatography seems to show some promise of usefulness in taxonomic work. It is still in early stages of development and will undoubtedly need to be improved. The use of other solvent systems and the two-dimensional method will furnish additional information but probably the biggest advance will come from the chemical identification of the spots.

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BRACHYDINIUM, A NEW GENUS OF THE DINOCOCCALES FROM THE INDIAN OCEAN.

By F. J. R. Taylor

(With Plate VIII)

(*Oceanography Department, University of Cape Town*)

During an analysis of phytoplankton material gathered from the South West Indian Ocean by the S.A.S. "Natal", unicellular organisms of an unusual nature were observed. From their structure they appeared to be vegetative stages of some species of Dinococcales, possessing an essentially Protococcalean type of organisation with homogenous cell walls, lacking plates, grooves or flagellae. However, it was not possible to assign them to any of those genera described in Schiller (1937), the most comprehensive systematic work including this group.

There have been eight genera described within this order of the Dinophyceae, arranged into four families. Of these genera *Pyrocystis* Murray and *Thaurilens* Pavillard appear to be the only ones with marine representatives, the former being common in warmer waters. All autotrophic genera belong to the family Phytodiniaceae Klebs, and the genus described in this paper would seem to belong to this family as it has well developed chromatophores.

BRACHYDINIUM F. J. R. Taylor gen. nov.

Cellulae nonmotae, singulae, in mare natatione, lateraliter compressae, cum cornubus cavis atque chromoplasmam etiam continentibus; chromatophorae numerosae, irregularis; nucleus patens.

Single non-motile cells in the vegetative stage, planktonic in the sea. Narrow horn-like processes arise from the cell body, and the cell contents penetrate them completely. The chromatophores are numerous, irregularly-shaped bodies, found also in the processes. The nucleus is large and distinct, clearly visible without staining.

Type species: *Brachydinium capitatum* sp. nov.

When considering possible affinities of the genus it would seem that it belongs to the family Phytodiniaceae. The detailed cell structure resembles the genera *Cystodinium* Klebs and *Tetradinium* Klebs, both fresh water genera, but is notably different from them in that the cell contents including the chromatophores penetrate the processes.

Brachydinium capitatum F. J. R. Taylor sp. nov.—Cellulae nonmotae, delicatulae, in mare natatione cum quattuor cornubus elongatis arcuatis ex uno plano excurrentibus, lateraliter compressae parte dorsale quasi operculum cum

duobus cavis oppositis in axillis inter eodem cornubusque dorsalibus; chromatophorae numerosae, irregularis; nucleus patens, parietalis.

Habitat: In mare Indica.

The vegetative cells occur singly, planktonic in oceanic waters. They are free-floating, non-motile, laterally compressed organisms possessing four elongate curved processes arising from the angles of the cell body, and in the same plane as the lateral compression. The distal portions of the processes are more or less curved away from the plane of compression when viewed either dorsally or ventrally Between the two dorsal processes there is a distinct capitate protuberance which is sharply delimited by two indentations at the junctions with the processes. The indentations do not appear to be linked by a continuation over the surface of the cell body. The nucleus is distinct as a large granular area displaced to one side (parietal). The cell possesses a number of irregular chromatophores which are most striking in the processes where they are largest, and may swell the walls somewhat. They are a bright yellow-green in colour. The cell wall is thin and hyaline, with no plates or other structural modifications visible upon it.

For convenience in description the author has considered the surface marked by the capitate protuberance as dorsal, this being a purely arbitrary choice.

Distance from tip to tip of the dorsal processes ..	95—123 μ
Length of the cell body	31— 46 μ
Depth of the cell body at the narrowest	10— 12 μ
Width of the cell body	9— 10 μ
Length of the processes	26— 40 μ

Iconotype: Plate 1, figure 1.

Type locality: South West Indian Ocean.

Reference material: T N I–1, and –2, in the Bolus Herbarium, Cape Town.

Abundance in the material (mixed phytoplankton): Very rare.

The species is interesting in that the cells appear to exhibit a structural adaptation to their environment, namely, the production of elongate processes. This phenomenon is commonly found among phytoplankton species of many different groups, and it is thought to be a means of counteracting sinking below the upper, sunlit (euphotic) zone. In this connection it might also be noted that the specimen from the more northerly station in less dense water (see pl. 1, fig. 3) exhibited a greater elongation of processes which showed a more marked curvature than those of the more southerly specimen.

The two individuals illustrated were found at stations some distance from land, and it is possible that the species is truly planktonic (holoplanktonic).

The exact localities and station numbers where the specimens were found are as follows:

Station N I O E 30—38° 50″ S, 27° 33.5″ E.
N I O E 71—33° 21″ S, 30° 30.0″ E.

No stages of reproduction have as yet been observed. However, the other genera to which it appears to be related reproduce by the formation of zoospores or autospores.

A controversy exists over the significance of the non-motile stage in the classification of the group, as the zoospores of some of the species closely resemble members of the Gymnodiniales, notably those of some species of *Cystodinium* Klebs. Klebs (1912), Kofoid and Swezy (1921), and Lindemann (1928) have considered the mother cells as cystic, and have thus included the group among the Gymnodiniales due to the affinities of the motile stages. However, Fritsch (1935), Pascher (1927), Graham (1951), and Smith (1955) have considered the motile stages as zoospores (homologous with those of the Chlorococcales), and the present author has followed the latter system.

Thanks are due to Mr. Richard Simons, South African Government Algologist, for aid in the Latin diagnoses, and to the C.S.I.R. for the funds provided for research resulting in this publication.

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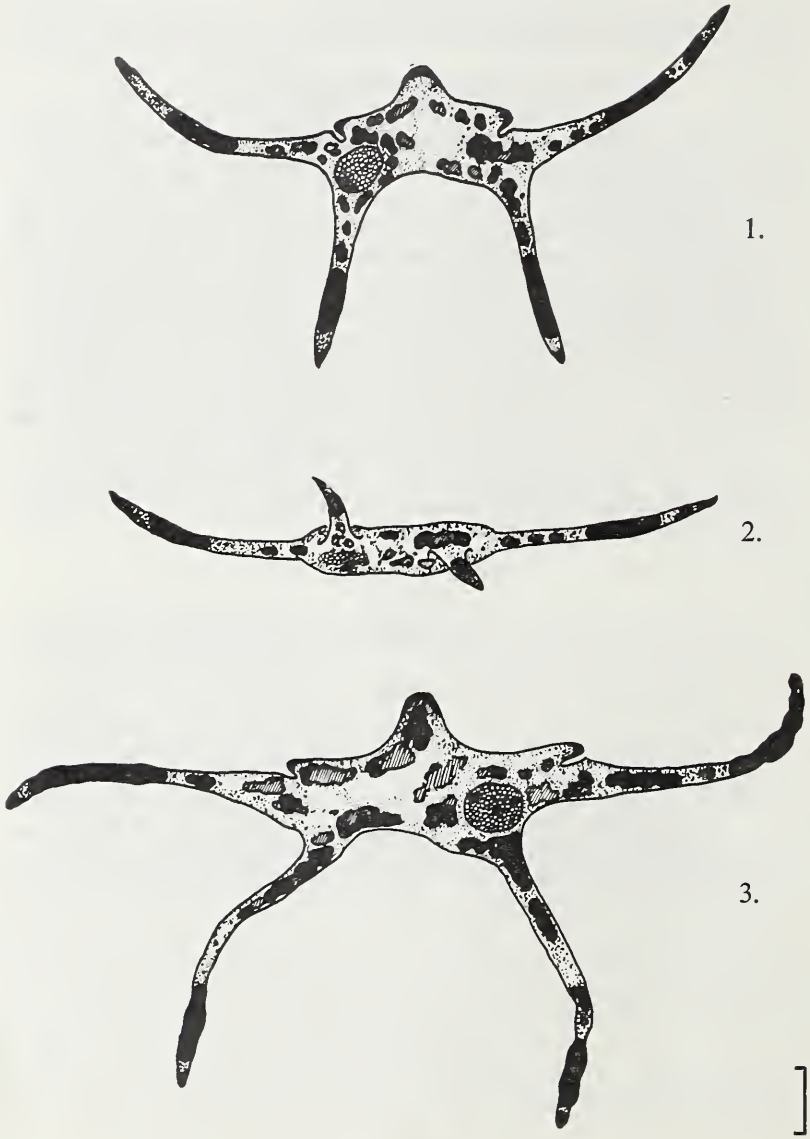

PLATE VII.

(Scale represents 10μ)

Fig. 1. Typical appearance of specimen from the South West Indian Ocean (Iconotype).
Fig. 2. Ventral view of same.
Fig. 3. Larger specimen from warmer water.

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STUDIES ON THE EMBRYOLOGY AND RELATIONSHIPS OF SOUTH AFRICAN GENERA OF THE HAEMODORACEAE:

ERRATA

Journal of South African Botany, Vol. XXIX, Part III.

"Two New Species of Huernia from South-western Arabia" by J. Lavranos.

Page 97, par. 3, line 3, for "Lavranos 1958" read "Lavranos 1858".

Page 98, par. 7 and 8, for "*H. marnieri*" read "*H. marnieriana*".

"Three New Species of Caralluma from South-western Arabia" by J. Lavranos.

Page 103, par. 3, line 4, for "Lavranos 1788" read "Lavranos 1778".

Page 106, line 2, omit "mm." after "5–9".

Onder die mikropiel vergroot die nucellus deur peri- en antiklinale seldelings van die dek-sel en die nucellusepidermisselle. Later word meeste van die nucellus geresorbeer, behalwe vir die weefsel aan die basis.

Die endospermontwikkeling is heelwaarskynlik helobiaal. Die klein basale endosperm-kamer het verskeie kerne maar vorm nie 'n haustorium nie. Uit die boonste kamer ontstaan die endospermweefsel, na 'n groot aantal vrye kerne eers gevorm is.

Uit 'n lineêre viersellige pro-embrio ontstaan die gedifferensieerde embrio, in alleen één van die ses saadknoppe. Die saadhuid word van beide integumente gevorm, maar oorweënd van die buitenste.

Die embriologiese kenmerke van *Lanaria* stem beter ooreen met die van die Tecophilaeaceae as met die Haemodoreae of die Conostyleae—die twee tribusse waarin *Lanaria* tot dusver geplaas was. Hierdie ondersoek toon dus dat die sistematiese posisie van *Lanaria* waarskynlik nie reg is nie, en dat dit nader verwant is aan die Tecophilaeaceae.

1.

PLATE VII.

(Scale represents 10μ)

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STUDIES ON THE EMBRYOLOGY AND RELATIONSHIPS OF SOUTH AFRICAN GENERA OF THE HAEMODORACEAE: LANARIA AIT.

MIRIAM P. DE VOS

(*Department of Botany, University of Stellenbosch*)

ABSTRACT

The embryological development of *Lanaria plumosa* is given. It shows a greater similarity to that of genera of the Tecophilaeaceae of Hutchinson's system than to the Haemodoreae or the Conostyleae, the tribes to which *Lanaria* has been assigned by various taxonomists. This suggests that the position of this monotypic genus in present taxonomic systems is probably not correct and that it stands closer to the Tecophilaeaceae than to the Haemodoreae or the Conostyleae.

SAMEVATTING

Embriologiese ondersoek by die monotipiese endemiese *Lanaria plumosa* toon dat die selwande van die jong stuifmeelkorrels gelyktydig aangelê word. Die generatiewe sel word proksimaal aangelê in die stuifmeelkorrel. Die helmknop het 'n gewone sekresietapetum.

Twee anatrope saadknoppe in apotrope posisie is in elke vrugbeginselhok aanwesig, elk met twee integumente en 'n klein obturator aan die basis. Die buitenste integument is dik en die mikropiel word deur beide gevorm.

'n Dek-sel word van die sub-epidermale archesporiumsel afgesny. 'n Ry van vier makrospore ontstaan, en die basale een ontwikkel op die normale wyse tot kiemsak.

Onder die mikropiel vergroot die nucellus deur peri- en antiklinale seldelings van die dek-sel en die nucellusepidermisselle. Later word meeste van die nucellus geresorbeer, behalwe vir die weefsel aan die basis.

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INTRODUCTION

Lanaria, a monotypic genus with one species, *L. plumosa* Ait., is localized in the south coast districts of the Cape Province, from Somerset West to Albany. It is distinguished by regular trimerous flowers with six stamens and a semi-inferior ovary, the whole flower and also the inflorescence being densely covered with long white plumose hairs.

Taxonomists have differed about its systematic position. Bentham & Hooker (1883) place it in the Haemodoraceae, tribe Euhaemodoreae, together with nine other genera, three of which, *Wachendorfia*, *Dilatris* and *Barberetta*, are endemic in South Africa, two in Australia and the other four in the Americas.

Pax (1930) in Engler and Prantl's work, reduces the Haemodoraceae to a small family characterised by three stamens opposite the inner perianth segments. The family is thus limited to eight genera of Bentham and Hooker's Euhaemodoreae, and the genus *Pauridia*. On account of their six stamens the genera *Lanaria* and *Phlebocarya* are transferred to the Conostylideae, and this tribe to the Amaryllidaceae subfamily Hypoxidoideae.

Hutchinson (1944), on the other hand, again transfers the Conostyleae to the Haemodoraceae which then consists of the two tribes Conostyleae and Haemodoreae (i.e. Euhaemodoreae of Bentham and Hooker). At the same time he returns *Lanaria* and *Phlebocarya* to the tribe Haemodoreae where Bentham and Hooker had placed it. This tribe is then characterised by the possession of three or six stamens, a very short or no perianth tube, and 2-seriate perianth segments. In the Conostyleae the perianth tube is often fairly long and curved and the segments are l-seriate and subvalvate.

In an attempt to determine the relationships of *Lanaria* more precisely, its embryological development has been investigated and compared with that of other related genera. The results are given below.

Investigation

Material and Method. Young flower buds and older stages of the flowers of *Lanaria plumosa* obtained from the Caledon Division, were fixed in FAA. It was necessary to dissect older ovules out of the ovaries, as the hairy ovary walls hindered sectioning. After embedding in paraffin wax the material was cut 12—15 μ in thickness and stained either with Delafield's or with Heidenhain's haematoxylin, the latter frequently used in combination with fast green.

Pollen.—The reduction division in the anthers occurs at about the time when a parietal cell is cut off in the young ovule. The formation of cell walls in the pollen mother cells is simultaneous, occurring after the second reduction division. The generative cell of the pollen grain is more or less spindle-shaped

and is formed against the proximal cell wall, i.e. opposite the groove (Figs. 18, 19).

No periplasmodium is formed in the anthers and the tapetum is a secretion tapetum which is still to be seen as a well-developed layer of the anther wall at the time when the young pollen grains are freed from the walls of the pollen mother cells. The tapetal cells become two- or more-nucleate but later the nuclei usually fuse to form large polyploid nuclei.

Position and form of ovule. The ovary, which is nearly completely inferior, has a conical tip protruding for a short distance into the perianth tube. It is trilocular and has two anatropous ovules placed side by side in each chamber, one ovule occasionally slightly higher than the other. From the small axile placenta situated near the base of each chamber, the two very short funiculi ascend, and the ovules are placed with their micropyles pointing downwards and outwards (Figs. 1, 7), i.e. their position is apotropous.

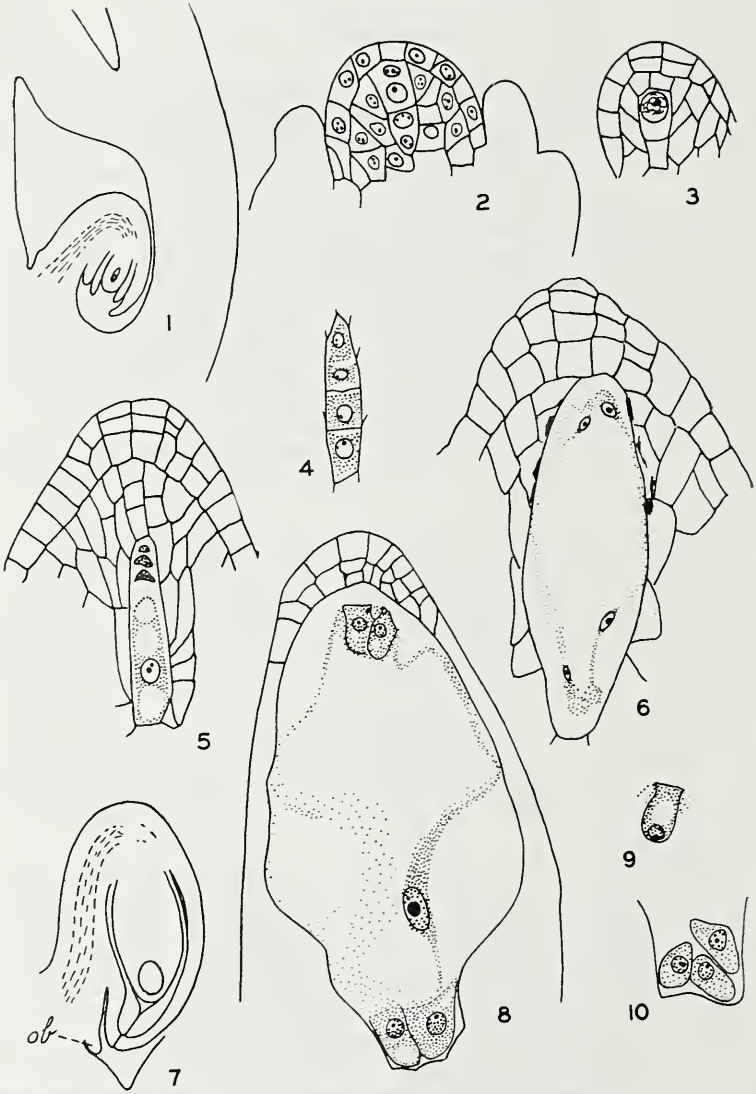
A small protuberance develops from the base of the funiculus (Fig. 7). Although slightly smaller, it is comparable to the obturator described by Cave (1952) in *Odontostomum*. It has papillose epidermal cells, rich in protoplasmic contents.

Integuments. As is usually the case, the integuments begin their development very early as two annular collars around the base of the primordium of the nucellus, the inner slightly in advance of the outer integument. When the megaspore mother cell is ready for reduction division, the inner integument has already grown past the tip of the nucellus (Fig. 1). It consists of two cell layers except at its tip, where it develops a thick ring of tissue later, which helps to narrow down the endostomium.

The outer integument is thicker and consists of five or more layers of cells. Later it encloses the inner integument completely and takes part in the formation of the narrow micropylar canal. In most ovules the exostomium and endostomium do not lie in a straight line, and the micropylar canal therefore is crooked (Fig. 7).

Nucellus and embryo sac. The subepidermal archesporial cell which becomes evident at an early stage, divides by a periclinal wall to form a small parietal cell and a megaspore mother cell. The latter enlarges rapidly and becomes embedded under several (four to six) layers of nucellar cells, formed by periclinal divisions of the nucellar epidermis under the micropyle, and of the parietal cell (Figs. 3, 5). All these nucellar cells also divide anticlinally to keep pace with the enlarging megaspore mother cell.

When the megaspore mother cell is ready for reduction division, it is long and narrow and about one quarter the length of the ovule. After reduction division a row of four megaspores is formed. The chalazal one develops into



FIGS. 1–10.—*Lanaria plumosa*, longitudinal sections through the developing ovule. Fig. 1, longitudinal section of ovary chamber showing ovule with megaspore mother cell, × 50; 2, young nucellus after division of the archesporial nucleus, and before cytokinesis between the two daughter nuclei, × 350; 3, young nucellus with megaspore mother cell under a 2-layered nucellar epidermis and a parietal cell which had divided anticlinally, × 350. 4, row of four megaspores after reduction division, × 350; 5, functional megaspore enlarging while the others degenerate, × 350; 6, developing embryo sac with four nuclei, × 350; 7, ovule with mature embryo sac, × 50; *ob*, obturator; 8, 9, mature embryo sac showing two synergids, secondary nucleus and two of the antipodal cells in fig. 8, and the egg cell in fig. 9, × 250; 10, antipodal cells, × 250.

an embryo sac, while the other three degenerate (Figs. 4, 5). The nucleus of the chalazal megaspore undergoes three divisions and forms a normal 8-nucleate embryo sac which, when ready for fertilization, contains an egg cell, two synergids, a secondary nucleus and three small antipodal cells (Figs. 8–10). It is inversely pear-shaped, with a narrow projection at the base in which the antipodal cells lie. The latter degenerate slowly after fertilization.

While the embryo sac develops, the adjacent nucellar cells against its upper half degenerate, so that the mature embryo sac has its tip against the cell complex derived from the nucellar epidermis, which forms a small nucellar cap (Fig. 6). The cells derived from the parietal cell have therefore disintegrated. Along its side the embryo sac is covered by a one-layered nucellar epidermis and the disintegrated remains of other nucellar cells. At its base, however, the nucellus is still massive.

Fertilization was not observed, nor the entrance of the pollen tube into the ovule.

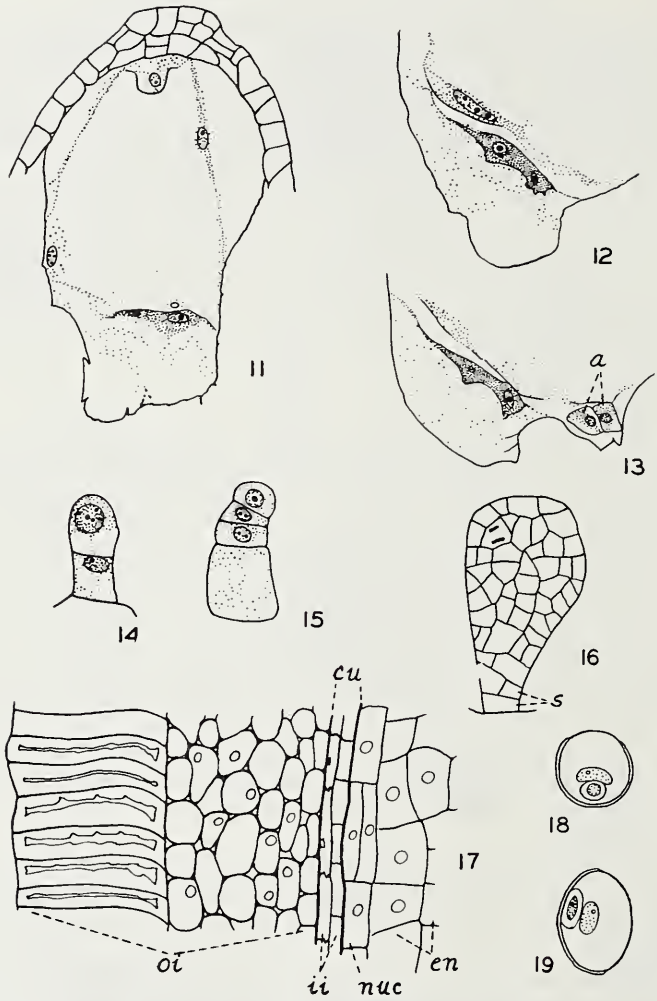
After fertilization the embryo sac enlarges so rapidly that the basal nucellar tissue is often split towards the chalaza. Most of this nucellar tissue is gradually absorbed, the embryo sac forming one to three shallow projections into it (Figs. 11–13). Absorption of this tissue is stopped by a zone of thicker-walled cells with irregular thickenings in the base of the nucellus.

The nucellar cap at the top remains intact for some time, but just below it part of the one-layered nucellar epidermis is now absorbed, so that the sac here touches the inner integument. Along the lower half of the embryo sac the nucellar epidermis remains intact and is still to be seen in the nearly ripe seed.

Only one of the six ovules develops into a seed and the others degenerate. The causes of this degeneration are unknown. Occasionally it starts before the flower opens, and such embryo sacs are narrow and shrivelled. Usually, however, it sets in after fertilization, as often four or five of the ovules in an ovary reach the stage of endosperm development where about four free endosperm nuclei are present.

Other abnormalities are rare. One young ovule was observed with two nucelli, separated by a single inner integument and enclosed in an outer integument common to both. In a few cases three ovules were seen in an ovary chamber instead of two.

Endosperm. Although the first division of the primary endosperm nucleus has not been observed, it is probable that the endosperm development is of the helobial type. Young stages with four, eight and sixteen endosperm nuclei show half of these collected in a dense mass of cytoplasm near the base of the embryo sac and cut off from the others by a very thin membrane. This basal endosperm chamber often develops obliquely above the antipodal cells and nearer the side of the raphe, in a slight hollow (Figs. 11–13).



FIGS. 11–17.—*Lanaria plumosa*, sections through developing seed. Fig. 11, embryo sac after fertilization, with zygote, basal endosperm chamber and several endosperm nuclei, × 200; 12, 13, consecutive sections through basal endosperm chamber, × 200; *a*, antipodal cells; 14, two-celled proembryo, × 350; 15, four-celled proembryo, × 350; 16, still undifferentiated young embryo, × 200; *s*, suspensor; 17, developing seed coat in lower half of seed, × 200; *cu*, middle and inner cuticular layers; *en*, endosperm cells; *ii*, inner integument; *oi*, outer integument; *nuc*, nucellus.

FIGS. 18, 19.—Sections of young pollen grain, showing vegetative nucleus and generative cell, × 600. Fig. 18, cross section; 19 longitudinal section.

At this stage the antipodal cells are still visible (Fig. 13). They disintegrate slowly somewhat later. Directly below them is a small group of resistant nucellar cells which remain small in size, whilst the other nucellar cells adjoining them first enlarge to keep pace with the growing embryo sac, and later get torn and disintegrate.

It was found extremely difficult to make good microscopical preparations of young endosperm stages. The probable reason for this is that the embryo sac enlarges so rapidly and is possibly so flaccid that good fixation is next to impossible. The embryo sac in this stage always shows extreme plasmolysis, and part of the young endosperm layer is often torn away from the embryo sac wall (Fig. 11).

The nuclei in the upper endosperm chamber divide repeatedly and lie in a single layer in the thin layer of peripheral cytoplasm. A large vacuole occupies the centre of the embryo sac.

Cell wall formation in the embryo sac takes place late, when the seed has already reached its full size. At this stage there are probably more than a hundred free endosperm nuclei present, still lying in a single layer in the peripheral cytoplasm. After formation of cell walls, the embryo sac rapidly fills up with thin-walled endosperm tissue which at first contains starch, and later protein and oil.

The basal endosperm chamber has dense cytoplasm and several nuclei. No cell wall formation takes place here. It occupies a slight hollow in the nucellus. This is so shallow that it cannot be rightly termed a haustorium.

Embryo. Only the initial stages of the development of the proembryo were seen. Before cytokinesis occurs in the endosperm the zygote divides transversely (Fig. 14). Two further transverse divisions occur, so that a four-celled proembryo is formed with the four cells in a row (Fig. 15). The lower cell is larger than the others and forms a short suspensor. Later stages show that the suspensor remains small and consists of only a few cells, one basal and two above the basal cell (Fig. 16). It is uncertain whether the two upper suspensor cells have been formed by division of the basal or second cell of the four-celled proembryo. The nucellar cap to which the suspensor is attached, gradually disappears.

In the ripe seed the slightly curved embryo is differentiated, and about one half the length of the endosperm tissue. It lies embedded loosely in the endosperm, except for the root tip which projects into a cavity under the seed coat near the micropyle.

Seed coat. The seed coat is smooth, black, hard and brittle, and is formed mainly from the outer integument (Fig. 17). Its outer epidermal cells are palisade-shaped with thickened cell walls, giving at first a cellulose reaction. Later these cells turn brown and then black, but just before this stage the middle lamellae

stain red with Sudan III, indicating the presence of a suberin-like substance. The black colour of the older cells prevented more microchemical tests being made.

The remainder of the outer integument consists of five or more layers of rounded parenchymatous cells with intercellular spaces, large vacuoles, and thick layers of peripheral cytoplasm containing starch. The inner epidermis of this integument remains small-celled and thin-walled.

Except at its thickened tip the inner integument still consists of only two cell layers which have remained thin-walled. The cells of its outer layer are large and flattened, with folded anticlinal walls, and with very little protoplasm. The cells of the inner layer are somewhat smaller, show no compression, and are rich in protoplasmic contents which take up much haematoxylin. The protoplasm also shows the presence of protein, with Millon's reagent.

The seed coat has three thin cuticular layers: on the outside, between the two integuments, and the third inside the inner integument. Inside the latter there is in the upper half of the seed a cellulose layer probably formed from cell membranes of the disintegrated nucellus. A layer of nucellar cells persists in the lower half of the almost ripe seed (Fig. 17).

At the micropyle the outer integument is unable to keep pace with the enlarging endosperm. The exostomium widens, thus forming a weak spot in the seed coat through which the radicle grows when germinating. This "germ pore" is closed only by the massive parenchymatous tip of the inner integument.

In the chalazal end of the seed is an air space where the basal nucellar tissue has been absorbed by the developing endosperm.

Germination. The seeds are dry in February and March. No period of after-ripening is necessary and germination takes place within three weeks. Of ten seeds tested, all germinated.

Discussion

Table 1 summarizes the important embryological characters of *Lanaria* and genera of the tribes Haemodoreae and Conostyleae, and the Tecophilaeaceae, a family re-established by Hutchinson, to include the Conanthereae of Bentham and Hooker and the Cyanastraceae of Engler & Prantl's system. The genera mentioned are the only ones in these groups whose embryological characters have been worked out. All the genera have a similar early embryo sac development. *Lanaria* agrees in its embryological characters more closely with the genera of the Tecophilaeaceae than with those of the Haemodoreae and the Conostyleae, the tribes to which it has been assigned. It differs from these two tribes in pollen development, character of the tapetum, ovule shape, size of antipodal cells, thickness of outer integument, and in the presence of an obturator near the micropyle.

It agrees with the genera of the Tecophilaeaceae—and especially with *Odontostomum*—in pollen development, absence of an amoeboid tapetum, early ovule development, ovule shape, position and number, and with *Odontostomun* and *Cyanastrum* in the presence of an obturator. The only point in which it differs from all three genera of the Tecophilaeaceae is in the width of its embryo sac. As the presence of an embryo sac haustorium has been investigated in only four of the eight genera, this character is left out of consideration.

TABLE I.
Embryological characters of *Lanaria* and genera of the Haemodoreae, Conostyleae and Tecophilaeaceae.

	Haemodoreae			Conostyleae	Tecophilaeaceae			Lanaria
	Wachendorfia	Dilatris	Xiphidium	Anigosanthus	Odontostomum	Cyanella	Cyanastrum	
Amoeboid tapetum ..	+	+	+	+	0	0	0	0
PMC	succ.	succ.	succ.	succ.	sim.	sim.	sim.	sim.
Generative cell	dist.	dist.			prox.	prox.	prox.	prox.
Parietal cell	+	+	+	+	+	+	+	+
Megaspores	4 lin.	4 lin.	4 lin.	4 lin.	3 lin.	4–3 lin.	3 lin.	4 lin.
E.s. development ..	NT	NT	NT	NT	NT	NT	NT	NT
Form of e.s.	narrow	wide		wide	narrow	narrow	narrow	wide
Antipodal cells ..	large	large		large		small	small	small
Endosp. development	He	He			prob. He	Nu	prob. Nu	He
E.s. haustorium ..	+	+				+		0
Outer integ.	2 lay.	2 lay.		prob. 2 lay.	thick	thick	thick	thick
No. of ovules	1	1	∞	∞	2	∞	2	2
Form of ovules ..	hemi.	orth.	orth.	orth.	ana.	ana.	ana.	ana.
Ovule position ..	down.	down.	± down.	± down.	apotr.	sideways	apotr.	apotr.
Obturator	0	0	0		+	0	+	+
Authority	Dellert 1933 De Vos 1956	De Vos 1956	Stenar 1938	Stenar 1927	Cave 1952	De Vos 1950	Fries 1919 Nietsch 1941	present

Abbreviations used: *ana.*, anatropous; *apotr.*, apotropous; *dist.*, distal; *down.*, ovule with micropyle directed downwards; *endosp.*, endosperm; *e.s.*, embryo sac; *hemi.*, hemitropous; *He*, helobial; *lay.*, layers of cells; *lin.*, linear; *no. of ovules.*, i.e. per ovary chamber; *NT*, normal type; *Nu*, nuclear; *orth.*, orthotropous; *PMC*, pollen mother cells; *prox.*, proximal; *sim.*, simultaneous formation of pollen grains in PMC; *succ.*, successive formation of pollen grains. Symbols: +, present; 0, absent.

In seed structure, however, *Lanaria*, *Cyanella* and *Cyanastrum* differ considerably. The seed of *Cyanastrum* has food-storing chalazosperm probably developed from chalazal tissue outside the vascular bundle, no endosperm and a large well-developed embryo (Fries 1919, Nietsch 1941). *Cyanella* and *Lanaria*

have well-developed endosperm and differentiated, but small embryos, with polyembryony occurring in Cyanella, but no chalazosperm. In *Cyanella*, furthermore, the chalazal tissue changes into a dry appendage in the ripe seed. No such development takes place in *Lanaria*. The development of the *Odontostomum* ovule after fertilization has not been investigated.

Erdtman (1952) found that pollen structure also points to the fact that *Lanaria* stands closer to the Tecophilaeaceae than to the Conostyleae. He states (p. 46): "It is doubtful, however, whether *Lanaria* and *Lophiola* should be placed in the same tribe as the pollen morphologically very different Australian genera *Anigozanthos*, *Blancoa*, *Conostylis* and *Tribonanthes*. As to size and maybe also exine stratification *Lanaria* and *Lophiola* have more characters in common with Hypoxidoideae-Conanthereae"—i.e. the Tecophilaeaceae—"than with Haemodoraceae sensu Pax".

Certain groups of the Liliaceae (the subtribe Asphodelinae, tribe Aloineae, and genus *Tofieldia*) and the genus *Ixiolirion* of the Amaryllidaceae, widely separated in taxonomic systems, show the same combination of embryological characters as *Lanaria* and genera of the Tecophilaeaceae, viz. simultaneous development of cell walls in the pollen mother cells, proximal position of the generative cell, and in the ovule: presence of a parietal cell, normal type of embryo sac development, helobial endosperm development, absence of an embryo sac haustorium and presence of an aril (Cave 1953, Schnarf and Wunderlich 1939, Seelieb 1924, Stenar 1924). According to Cave and to Schnarf and Wunderlich the Asphodelinae and Aloineae are undoubtedly related.

The problem is whether all these groups showing a similar embryological development are related, or whether the set of embryological features found here, evolved more than once in a number of unrelated groups—this seems hardly possible. In other words, are embryological characters of greater importance than adult characters in indicating relationships? It has been suggested that the internal structure of a flower (and therefore its embryological features) must be more conservative than the external, being less amenable to environmental influence, and that such characters are of special value in judging the proper position of certain doubtful groups (Maheshwari 1945). It must be left to the future to decide to what extent the relationships between the above-mentioned groups, indicated by a similar early embryological development, should be reflected in their classification.

Anatomical investigations have been carried out on *Lanaria* and allied genera by Schulze (1893), Schmidt (1891), Scharf (1892) and Solereder (1917), but are not conclusive. Schulze found that the genera of the Conanthereae he studied have no subsidiary cells to their stomata, but that they are present in the Haemodoreae and Conostyleae. This indicates that the Conanthereae are not closely related to the two latter groups. In *Lanaria* and *Lophiola* he found subsidiary

cells hardly or not distinguishable from the thin-walled epidermal cells. In *Cyanastrum* subsidiary cells are present (Solereder).

Lanaria has trichomes similar in structure to those of *Anigosanthus* and *Conostylis*, while the Conanthereae are glabrous, except for *Cyanella capensis* which has short protuberances on the leaf margins (Schulze). On the other hand, *Lanaria*, *Lophiola*, *Tribonanthes* and *Phlebocarya* disagree in phloem structure from the rest of the Conostyleae, according to the same author.

Anatomically *Lanaria* and *Lophiola* have characters in common, and this indicates that the two genera might be related. The similar pollen structure also points this way. Unfortunately the embryological development of *Lophiola* has not been investigated. Anatomical evidence has not been of help so far in deciding the further relationships of *Lanaria*. It has some anatomical characters in common with the Conostyleae and others with the Conanthereae (Tecophilaeaceae).

The conclusion that can be reached from a knowledge of the embryology of *Lanaria* and allied genera, is that its position in present classifications is probably not correct. Its embryological development indicates a closer relationship with genera of the Tecophilaeaceae (and a few other groups of the Liliaceae and Amaryllidaceae at present widely separated in orthodox taxonomic systems) rather than with the Haemodoreae or the Conostyleae, the tribes to which it has been assigned.

More embryological work on related genera, e.g. *Lophiola*, *Phlebocarya*, and genera of the Tecophilaeaceae is necessary to determine Lanaria's nearest relations.

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THE IDENTITY OF SOME FERN TYPES IN THE THUNBERG HERBARIUM

E. A. C. L. E. Schelpe
(*Bolus Herbarium, University of Cape Town*)

ABSTRACT

Among the ferns described by Thunberg in his Descriptio Caenopteridis (1795) and in his Prodromus Plantarum Capensium (1800), there are a few whose identity has been uncertain for many years. However, an examination of the holotypes in the Thunberg Herbarium has made it possible to establish the identity of these taxa.

Polypodium tottum Thunb.

Christensen, in his Index Filicum (1906), referred this with some doubt to the genus Dryopteris, while Sim (1915) considered it a possible synonym of *Dryopteris africana* (Desv.) C.Chr. The holotype, which consists of a single sterile frond without a rhizome, is annotated as having been collected by Thunberg at the Cape. It is clearly a specimen of what is currently known as *Cyclosorus gongylodes* (Schkuhr) Link. The sheet is also annotated "*A. unitum M.*" by Mettenius which can be taken to mean that he misidentified this specimen as the closely related *Cyclosorus unitus* (L.) Ching. Juel (1918), apparently following Mettenius' opinion, referred it to "*Dryopteris unita* (L.) O. Ktze.?".

Polypodium tottum Thunb. (1800) obviously antedates *Aspidium gongylodes* Schkuhr (1809), the basionym of *Cyclosorus gongylodes* (Schkuhr) Link, making a new combination necessary. However, as the genus Cyclosorus cannot be segregated satisfactorily from the genus Thelypteris in the opinion of the author and other contemporary pteridologists, the new combination proposed here for this taxon is *Thelypteris totta* (Thunb.) Schelpe comb. nov. (Basionym: *Polypodium tottum* Thunb., Prod. Fl. Cap.: 172 (1800)).

Judging from the known distribution of this fern in South Africa and the fact that Thunberg only travelled as far east as the Sundays River, near Port Elizabeth, this holotype was most probably collected near the hot springs at Brand Vlei near Worcester or in the Port Elizabeth—Uitenhage area.

Pteris confluens Thunb.

Christensen (1906), followed by Sim (1915), regarded this as a synonym of *Pellaea auriculata* (Thunb.) Fée. The specimen in the Thunberg Herbarium consists of two sterile fronds, which, without any doubt, can be referred to *Thelypteris palustris* Schott var. *squamigera* Schlechtend. The scales along the costae on the undersurface of the fronds, characteristic of the variety, are present.

Pteris cuspidata Thunb.

Although Sim (1915) regarded this as representing a juvenile form of Marattia, it was correctly assigned to the genus Angiopteris by Christensen (1906). The holotype consists of a portion of a sterile frond and is most probably a specimen of *Angiopteris evecta* (Forst.) Hoffm. which Thunberg could have collected either during his stay in Java in 1776–1777 or on his visit to Ceylon in 1777–1778.

Caenopteris auriculata Thunb.

Asplenium thunbergii Kunze is a *nomen novum* for *Asplenium auriculatum* (Thunb.) Kuhn non Swartz of which the basionym is *Caenopteris auriculata* Thunb. This species has been attributed to South Africa for over a century and a half and South African specimens have been named *A. auriculatum* (Thunb.) Kuhn or *A. thunbergii* Kunze at least since the publication of Kuhn's Filices Africanae (1868).

The South African taxon identified as *A. auriculatum* or *A. thunbergii* is not known to occur south of Natal and it is virtually certain that Thunberg could not have collected this taxon in South Africa as he only travelled as far as the Sundays River in the vicinity of present-day Port Elizabeth. Consequently, a tracing and drawings of the holotype of *Caenopteris auriculata* Thunb., made in Uppsala, were compared with Asiatic species of Asplenium which Thunberg might have collected on his visits to Japan, Java and Ceylon. It became evident that Thunberg's holotype is conspecific with Javanese specimens of *Asplenium belangeri* (Bory) Kunze. As was pointed out by Holttum (1954), this is a later homonym of *Asplenium belangeri* Bory so that it is most probable that *Asplenium thunbergii* Kunze is the correct name for *Asplenium belangeri* (Bory) Kunze non Bory.

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ON THE TAXONOMY OF PELLAEA HASTATA (LINN. F.) LINK

E. A. C. L. E. Schelpe
(*Bolus Herbarium, University of Cape Town*)

ABSTRACT

A common and rather polymorphic fern endemic to the winter-rainfall area of the south-western Cape Province, has long been known as *Pellaea auriculata* (Thunb.) Fée. Two of its forms were illustrated by Sim in his Ferns of South Africa (1915; t. 89).

Pellaea hastata (L.f.) Link, based on *Adiantum hastatum* L.f., has long been regarded as a taxonomic synonym of *Pellaea viridis* (Forsk.) Prantl as construed by Christensen in his Index Filicum (1906). While checking the type description with the interpretations by various authors of *A. hastatum* L.f., it has been found that this name has been misapplied to species now known as *Pellaea calomelanos* (Sw.) Link and *Pellaea viridis* (Forsk.) Prantl.

The basionyms involved in the taxonomy of *Pellaea hastata* (L.f.) Link are, firstly, *Adiantum hastatum* L.f. and, secondly, *Adiantum auriculatum* Thunb. and *Pteris auriculata* Thunb.

Adiantum hastatum L.f.

In 1781, the younger Linnaeus described a plant with *pinnate* fronds and subsessile, hastate, trilobed pinnae having recurved crenulate margins, and gave it the name *Adiantum hastatum*. In the Linnaean Herbarium there are two specimens labelled "*hastatum*"; in the first (No. 1252/4) the annotation is in the elder Linnaeus' hand and the specimen, with pinnate fronds, is undoubtedly *Pellaea auriculata* (Thunb.) Fée sensu Christensen. The annotation on the second sheet (No. 1252/5) was written by the younger Linnaeus and the specimen, with tripinnate fronds, is without any doubt *Pellaea calomelanos* (Sw.) Link. It is obvious that the description published by the younger Linnaeus can only refer to specimen No. 1252/4 annotated by the elder Linnaeus and not to specimen No. 1252/5 which the younger Linnaeus apparently misidentified. Thus, specimen No. 1252/4 is the holotype of *Adiantum hastatum* L.f. which is the earliest name applicable to the fern which has been known as *Pellaea auriculata* (Thunb.) Fée.

Thunberg, in his Prodromus Plantarum Capensium (1800), transferred *Adiantum hastatum* L.f. to the genus Pteris but described a plant with supra-decomposite (not pinnate) fronds under his *Pteris hastata*, apparently following the error of the younger Linnaeus. Thunberg's specimen examined in Uppsala, annotated "*Adiantum hastatum*" confirms the fact that the plant Thunberg was describing was not *Adiantum hastatum* L.f. but another species which was described as *Pteris calomelanos* in 1801 by Swartz who, apparently, detected Thunberg's mistake. This specimen is also annotated "*Pteris calomelanos*" probably by Swartz.

In the same publication, Swartz (1801) cites under *Pteris hastata* both *Adiantum hastatum* L.f. and *Pteris auriculata* Thunb. as synonyms. Although Swartz was perfectly correct in regarding these two elements as belonging to the same species, he surprisingly erred in describing the fronds as supradecomposite instead of pinnate. In his Synopsis Filicum (1806) Swartz repeated this erroneous description, adding *Pteris polymorpha* Poir. as another synonym and remarking that *Adiantum hastatum* L.f. is a juvenile state of his *Pteris hastata* with simply pinnate fronds. Judging from a photograph of the holotype of *Pteris polymorpha* Poir. in Paris, seen at the British Museum (Nat. Hist.), this is conspecific with *Pellaea viridis* (Forsk.) Prantl sensu Christensen. Swartz' remark can thus be taken to mean that he regarded *Adiantum hastatum* L.f. as representing a juvenile stage of *P. viridis* (Forsk.) Prantl which he described under the name of *Pteris hastata*. This opinion is strengthened by the presence of a specimen of *Pellaea viridis* (Forsk.) Prantl sensu Christensen of unknown origin in the Thunberg Herbarium, which is annotated "*Pteris hastata*" probably by Swartz. Thus, Swartz initiated a second erroneous application of the younger Linnaeus' epithet *hastatum*, in this instance to what is known as *Pellaea viridis* (Forsk.) Prantl, an error which has been perpetuated by various authors for more than a century and a half. However, in mitigation, it must be noted that Swartz would not have been able to consult the specimens in the Linnaean Herbarium during the final preparation of his Synopsis Filicum as these had already been removed to England in 1784.

Adiantum auriculatum Thunb. and **Pteris auriculata** Thunb.

Thunberg, in his Prodromus Plantarum Capensium (1800), described both an *Adiantum auriculatum* and a *Pteris auriculata*, the former with pinnate fronds and the latter with bipinnate fronds. *P. auriculata* Thunb. was cited by Swartz (1801) as a synonym under his *Pteris hastata*, together with *Adiantum hastatum* L.f. In the same publication he transferred *Adiantum auriculatum* Thunb. to the genus Pteris making a new combination, *Pteris auriculata* (Thunb.) Sw., a later homonym of *Pteris auriculata* Thunb.

In the Thunberg Herbarium there are two sheets annotated "*Pteris auriculata* α" and "*Pteris auriculata* β", both of which are Thunberg collections from the Cape of Good Hope. The former (α) specimen is a plant of the pinnate form of *Pellaea hastata* (l.f.) Link, as construed here, which matches perfectly, Thunberg's amplified description of his *Adiantum auriculatum* given in his Flora Capensis (1823) although he did not annotate it "Adiantum auriculatum". The latter specimen (β) is a plant of the bipinnatifid form of the same species which is almost certainly the specimen which Thunberg described as his *Pteris auriculata*, judging from the amplified description given in his Flora Capensis.

SYNONYMY

The synonymy of *Pellaea hastata* (L.f.) Link is given below, but in order to avoid any confusion, the nomenclatural synonyms of the three elements are treated in three separate groups.

Pellaea hastata (L.f.) Link, Fil. Sp. Hort. Berol.: 60 (1841).
Adiantum hastatum L.f., Suppl.: 447 (1781).
Pteris hastata (L.f.) Sw. in Schrad. Journ., **1800** (2): 69 (1801) non Thunb. (1800).
Cheilanthes hastata (L.f.) Kunze in Linnaea, **10**: 532 (1836).
Allosorus hastata (L.f.) Presl, Tentamen: 153 (1836).
Cassebeera hastata (L.f.) J. Sm. in Journ. of Bot., **4**: 159 (1841).
Platyloma hastata (L.f.) Lowe, Ferns, **3**: t. 32 (1857).

Adiantum auriculatum Thunb., Prod. Fl. Cap.: 173 (1800).
Pteris auriculata (Thunb.) Sw. in Schrad. Journ., **1800** (2) : 69 (1801).

Pteris auriculata Thunb., Prod. Pl. Cap.: 172 (1800).
Cheilanthes auriculata (Thunb.) Link, Hort. Berol., **2**: 36 (1833).
Allosorus auriculatus (Thunb.) Presl, Tentamen: 153 (1836).
Cassebeera auriculata (Thunb.) J. Sm. in Bot. Mag., **72**, Comp.: 20 (1846).
Pellaea auriculata (Thunb.) Fée, Gen.: 129 (1852).

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TWO NEW SPECIES OF HUERNIA FROM SOUTH-WESTERN ARABIA

J. J. Lavranos

(With Plates IX and X)

Huernia marnieriana Lavranos, nov. sp., affinis *H. concinnae* N. E. Brown sed corolla valde brevi, corona albida, exteriore convexula lobis apice bifidis, interiore punicea differt.

Caules erecti, pentagoni, glauco-virides, brunnei maculati, 4—6 cm. longi, 14—17 mm. crassi dentibus exclusis; dentes conici compressi, acutissimi, tenus 8 mm. longi, patuli; flores 2—3 aggregati, ex basi caulium juvenium producti; bracteae lineares, acutae, 5 mm. longae; pedicelli teretes, glabri, 8—10 mm. longi, 1·5 mm. diam.; sepala linearea acuta, 6—8 mm. longa, glabra; coralla rotata sed brevissime campanulata, semper planiuscala, 33 mm. diametro, 2—5 mm. longa, extus lutescens, glabra, intus anguste rubro-marginata, lutescens, tuberculis rubris, conicis ubique induta; tubus 2—5 mm. longus, basi puniceus; lobi deltoidei, acuti, basi 12 mm. lati, 7—10 mm. longi; lobi intermedii breves, tenus 1 mm. longi, saepe absentes; corona exterior albescens, basi tubi adpressa, convexa 4·5—5·0 mm. diametro, lobis exterioribus latioribus quam longi, apice breviter bifido, puniceo; coronae interioris lobi 2·5 mm. alti, pallide punicei, supra antheras incumbentes et conniventes, dorso gibbosi.

Type Locality. Audhali Plateau, Southern Arabian Federation, on the rocky Western slopes of the Wadi Salul, some 3 miles S.S.W. of the village of Mukeiras, lat. 13° 55′ 30″ N., long. 45° 40′ E., alt. appr. 2,050 m., Lavranos 1958 (KEW, Holotype) fl. Pretoria 5 January, 1963. Also Lavranos 1859 from the same locality. Also from the middle slopes of the Aqaba Thirah, Audhali country N.W. of Lodar (Lavranos 1788).

Stems erect, 5-angled, glaucous-green mottled brown, 4—6 cm. long, 14—17 mm. diam. excluding the teeth; teeth conical rather, compressed, very acute up to 8 mm. long, spreading.

Flowers 2—3 from the base of young stems developed successively.

Bracts linear, acute, 5 mm. long.

Pedicel 8—10 mm. long, terete, glabrous 1·5 mm. thick.

Sepals linear, acuminate, 6—8 mm. long, light green, glabrous.

Corolla rather fleshy, shallow, broadly saucer-shaped, 33 mm. diam., 2—5 mm. long; *outer surface* cream in colour becoming brownish towards the apices of the lobes with five prominent nerves at the back of each lobe; *inner surface* whitish but pink at base of tube, with a narrow red margin, covered

throughout with conical red tubercles which are smaller towards the apices of the lobes; *tube* very shallow 2—4 mm. long; *lobes* broadly deltoid, acute, spreading, 12 mm. broad at base, 7—10 mm. long; *intermediate lobes* 1 mm. long, frequently absent.

Outer corona whitish, adpressed against the corolla-tube, convex, 4·5—5·0 mm. diam., the lobes broader than long, shallowly bifid and pink at their apices.

Inner corona lobes 2·5 mm. high, very pale pink, incumbent upon the anthers and not produced above them, with a pronounced gibbosity at the base of their deltoid, rather acute apices.

This peculiar species was one of several collections of *Huernia* made by the author at various points in S.W. Arabia during a short botanical reconaissance of that region in August, 1962.

It was found growing as isolated individuals on the Kor al Audhilla (Audhali plateau) of the Western Aden Protectorate, near the Yemeni border, on the steep rocky slopes of the Wadi Salul, in association with *Euphorbia balsamifera* Ait., *Adenium obesum* (Forsk.) R. & S., *Cotyledon barbeyi* Schweinf., *Acacia* spp., *Coleus barbacus* (Andr) Benth. etc., in an area which has never received the attention of botanists and which appears to receive an average rainfall of some 300 mm. The climate of the high plateau is generally temperate and light frosts occur in December, January and February.

Our species is clearly related most closely to *H. concinna* N. E. Br. from Somaliland but differs therefrom by the very shallow corolla which is almost flat. The corolla of our species is covered by red, conical, wart-like papillae whereas in its closest ally the papillae are bristle-like. The outer corona is whitish, characteristically convex, whereas in *H. concinna* it is dark purple brown. The inner corona lobes are light pink in colour whereas in the older species they are yellow.

H. marnieri, in habit and the form of its stems is very close indeed to the species and varieties of the *macrocarpa* section of the genus, while its coronal structure places it in White and Sloane's *macrocarpa-brevirostris* group.

The structure of the corolla in *H. marnieri* is rather abnormal. There is no trace of an annulus as is the case in all such members of the genus as have a saucer-shaped corolla. The intermediate corolla-lobes, in the specimens collected on the Kor al Audhilla, are entirely absent. This character, however, is not constant since in the plants collected on the Aqaba Thirah these lobes are well developed, though rather short.

Attention is also drawn to the peculiar conical gibbosity which arises at the point where the inner corona lobes bend over the staminal column, a feature reminiscent of the corona of *Duvalia sulcata* N. E. Br. In fact, were it not for the distinctly lobed outer corona, it would be difficult to decide whether to place

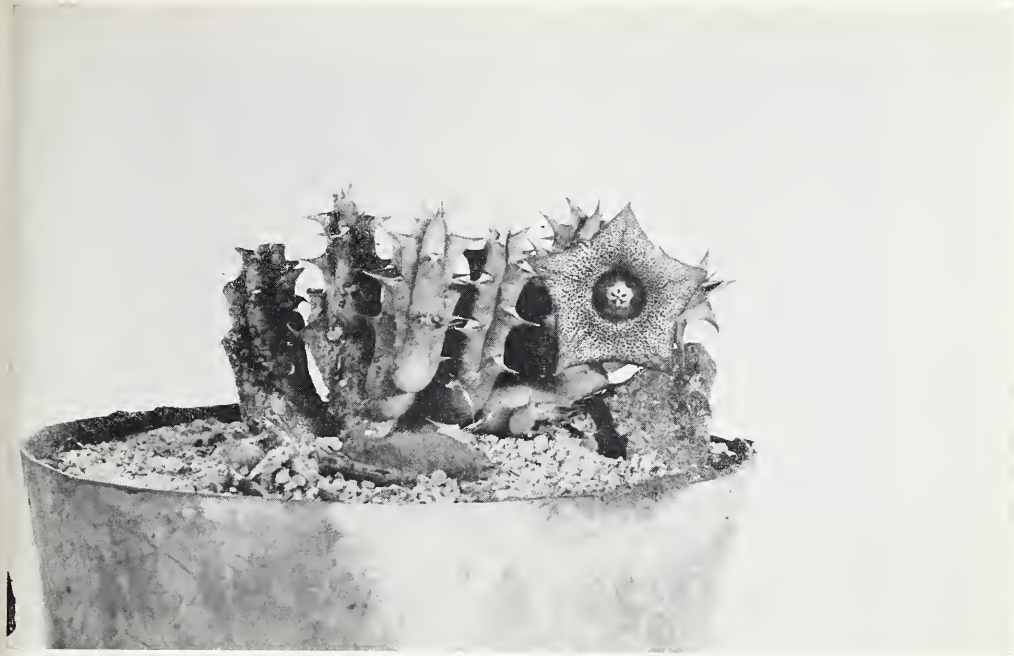

PLATE IX—FIG. 1.
Huernia marnieriana Lavranos. The type plant, actual size.
Photograph: Division of Botany, Pretoria.

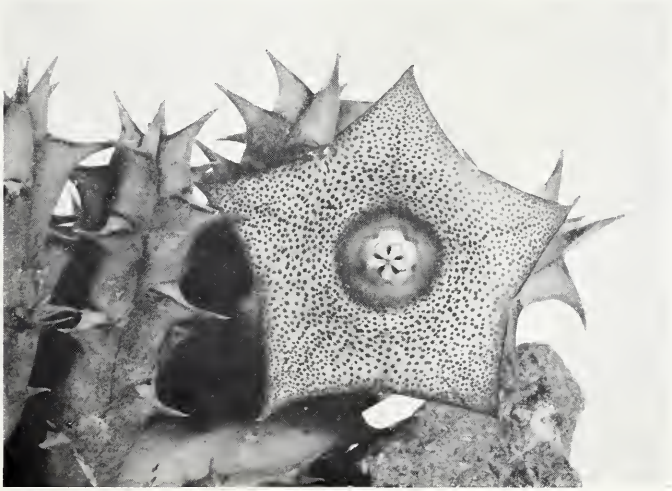

PLATE IX—FIG. 2.
Huernia marnieriana Lavranos, x2.
Photograph: Division of Botany, Pretoria.

PLATE X—FIG. 1.
Huernia hadhramautica Lavranos nov. sp. The type plant, actual size.
Photograph: L. Louis.

PLATE X—FIG. 2.
Huernia hadhramautica Lavranos nov. sp. appr. x2·5 natural size.
Photograph: L. Louis.

the form of our species in which the intermediate corolla lobes are absent in *Huernia* R. Br. or in *Duvalia* Haw.

The plant here figured was sent by the author to the Division of Botany, Pretoria, where it first flowered on 5 January, 1963 when the present description was drawn up. This description had to be somewhat modified when a plant from the Aqaba Thirah (Lavranos 1788) flowered on 25 January, 1963 and presented certain characters differing somewhat from those of the type-plant.

This species is named in honour of M. J. Marnier-Lapostolle of "Les Cèdres", St. Jean-Cap Ferrat, France, as a token of appreciation for his generous help, which assisted me in my exploration of South Western Arabia, and for his love of the Stapeliae.

Huernia hadhramautica Lavranos, nov. sp., affinis *H. macrocarpae* Sprenger, sed corona exteriore convexa, conica, albescente differt.

Caules erecti, robusti, pentagoni 4—6 cm. longi, 18—22 mm. crassi dentibus exclusis, glabri, canescentes, brunnei mucalati; dentes prominentes, compressi, acuti, tenus 12 mm. longi, patuli; flores, 1—3 ex basi caulium juvenium producti; bracteae lineares 1 mm. longae; pedicelli teretes, glabri, brunneo-virides, 4—5 mm. longi, 1·5 mm. crassi; sepala linearea, acuta, trinervia, carinata, minute puberula, 7—9 mm. longa; corolla late campanulata, 10 mm. longa, ca. 25 mm. lata inter apices loborum, extus punicea, dense sed minute papillata, intus fusca rubropurpurea, papillis parvis conicis induta; basis tubi punicea, glabra; lobi late deltoidei, acuti, basi ca. 12 mm. lati, 6 mm. longi, extus 7-nervii; lobi intermedii 1 mm. longi; corona exterior albescens, basi tubi adpressa, obtuse conica, 5 mm. lata, 3 mm. alta, lobis apice rotundatis, sectione convexis; coronae interioris lobi albi, 2 mm. alti, ex apice coronae exterioris producti, primum erecti, leviter divergentes, deinde supra antheras incumbentes sed non excedentes, conniventes, gibbosi, apice punicei.

Type Locality. Southern Arabia, Hadhramaut in rocky ravines at Mola Matr. lat 14° 47′ N., long. 48° 48′ E. North of Mukalla, on the main road to the Wadi Doan, est. altitude 1800 metres, Lavranos 1935 (KEW, Holotype) fl. Johannesburg 8th January, 1963.

Stems robust, 5-angled, ascending-erect, 4—6 cm. long, 22 mm. thick excluding teeth, glabrous, greyish mottled with brown; teeth very stout, elliptical in section, 12 mm. long, spreading, very acute.

Flowers 1—3 from the base of young stems, developed successively.

Bracts linear, 1 mm. long.

Pedicel terete, glabrous, purple-green, 4—5 mm. long, 1·5 mm. diam.

Sepals linear-acute, 3-nerved, carinate, minutely puberulous, 7—9 mm. long.

Corolla broadly campanulate, 10 mm. long, appr. 25 mm. diam. between

apices of lobes; *outer surface* cream with a pink tinge, densely covered with minute conical papillae; *inner surface* dark purple-red, covered with small conical papillae which are absent from the pink base of the tube; *lobes* broadly deltoid, acute, ca. 12 mm. broad at base, 6 mm. long, outside 7-nerved; intermediate lobes 1 mm. long.

Outer corona pinkish-white, adpressed against the base of the tube, rather obtusely conical, 5 mm. diam., 3 mm. high; lobes rounded at their apices, convex in section, separated from one another by a deep groove.

Inner corona lobes pure white, 2 mm. high, arising from the apex of the outer corona, at first erect, slightly divergent, then incumbent upon the anthers but not produced above them, connivent, gibbous, the apices pink.

This very beautiful species is closely allied to *H. macrocarpa* Spreng. from Eritrea, one of the varieties of which, var. *arabica* (N. E. Br.) White et Sloane, was collected in 1889 by Schweinfurth on Jebel Bura which is along the Western escarpment of the Yemen. Our plant differs, however, in its rather remarkable outer corona which is not flat but has the form of a 5-grooved cone with rounded lobes. The inner corona lobes arise from the grooves at the apex of this cone. This coronal structure is very unusual.

By its texture, the corolla of *H. hadhramautica* is strongly reminiscent of *H. keniensis* R. E. Fries. The dark colour of the corolla, which contrasts with the light-coloured base of the tube, reminds one of *H. occulata* Hook. f. and *H. similis* N. E. Br., both from Southern Angola, but the form and colour of the outer corona serve to distinguish our species.

H. hadhramautica marks the North-easterly limit of the genus as known at present. It is an altogether charming species with lovely flowers. It was found growing among limestone boulders on rocky slopes of minor dry water-courses tributary to the upper Wadi Himem near Mola Matr in the Hadhramaut. This locality is at an altitude of some 1800 m. at the southern edge of the Hadhrami Jol (high plateau), at the foot of the Kor Seiban which rises to over 2150 m. immediately to the North. Mola Matr means "The God of Rain" and while, as the name implies, it is situated in one of the rainiest areas of the Hadhramaut, it is still very dry and may receive an average of some 200 mm. of rain per annum, although this figure is purely conjectural as no rainfall data are available. The rainfall is mainly in the form of torrential thunder-showers. While we were in this area, on 21 and 22 August, 1962, thunderclouds piled up in the afternoon to the North of the Kor Seiban, but no rain fell where we were.

Our species was found growing in association with *Acacia asak* (Forsk.) Willd., *A. tortilis* (Forsk.) Hayne, *Euphorbia balsamifera* Ait. (syn. *E. adenensis* Defl.), *E. phillipsiae* N. E. Br., *Kalanchoe teretifolia* Defl., *Dorstenia foetida* Forsk., *Tarchonanthus camphoratus* L., *Euryops arabicus* Steud., *Aloe inermis* Forsk., various Acanthaceae, Stapelieae and others.

Living plants were sent to Johannesburg where one of them flowered on 8 January, 1963, when the present description was prepared and photographs taken.

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THREE NEW SPECIES OF CARALLUMA FROM SOUTH-WESTERN ARABIA

J. J. Lavranos

(With Plates XI–XIV.)

1. **Caralluma deflersiana** Lavranos nov. sp., affinis *C. sacculatae* N.E.Br. sed lobis corollae tubo longioribus, apicibus loborum coronae interioris non erectis differt.

Caules erecti vel ascententes quadranguli, 5—7 cm. longi, 12—15 mm. crassi, dentibus patulis, 8—12 mm. longis, glaucovirides, brunnei maculati; flores solitarii, ex parte apicale caulium juvenium producti; bracteae deltoideae, acutae, 2 mm. longae; pedicelli teretes, glabri, glauco-virides, erecti, 10 mm. longi, 3 mm. diam.; sepala deltoidea, acuta, glauco-viridia, 7 mm. longa, basi 2 mm. lata, apice leviter reflexa; corolla campanulata, extus glauco-virens, brunnea maculata; tubus cylindricus, basi rotundatus, 13 mm. longus, 10 mm. latus, intus basi puniceus, glabrus, deinde fusco purpureus dense sed minute tuberculosus; lobi ovati lanceolati, 18 mm. longi, basi 9 mm. lati, oblique ascendentes, marginibus leviter revolutis, intus fuscopurpurei, confertim sed minute puberuli; colonna staminalis 8 mm. alta; corona exterior 8 mm. diametro, cyathiformis, lobis 5, sacciformibus, basi rotundatis instructa, intus extusque punicea, marginibus loborum integris, fuscopurpureis; coronae interioris lobi 4 mm. longi, 0·75 mm. lati, lineares, fuscopurpurei, apice rotundati ed emarginati, oblique adscendentes, antheras arcte incumbentes, summo apice conniventes.

Type Locality: South Western Arabia, South Arabian Federation, Audhali country, 1 mile West of Lodar, alt. appr. 3,300 feet (1,000 metres), lat. 13° 52′ 30″— N., long. 45° 51′ 30″— E., coll. in flower 16 August, 1962, fl. Pretoria, 7 April 1963 (Lavranos 1788; KEW, holotype; PRE, isotype).

Stems densely tufted, ascending-erect, 4-angled, 5—7 cm. long, 12—15 mm. thick excluding the stout, horizontally spreading, acute, 8—12 mm. long teeth, grey-green with numerous, oblong, brownish spots.

Flowers solitary from near the apices of young stems.

Bracts deltoid, acute, 2 mm. long.

Pedicel terete, glabrous, erect, grey-green, 10 mm. long, 3 mm. thick.

Sepals deltoid, acute, glabrous, grey-green, 7 mm. long, 2 mm. broad at base, the apices slightly reflexed.

Corolla campanulate, outside grey-green with numerous brownish spots *tube* cylindric, not constricted towards the mouth, rounded at the very base,

13 mm. long, 10 mm. diam., inside pink and glabrous at base, thereafter dark purple-brown, densely but minutely tuberculate; *lobes* ovate-lanceolate 18 mm. long, 9 mm. broad at base, obliquely ascending, the margins somewhat revolute, inside dark purple-brown densely covered with minute bristle-like papillae.

Staminal column 8 mm. high.

Outer corona 8 mm. in diameter, 5-lobed, consisting of 5 intergrown concave pouches, opening laterally so that the sinuses between the lobes are situated higher than the apices, pink within and without, the margins of the lobes dark purple-brown, rounded, entire.

Inner corona lobes 4 mm. long, 0·75 mm. wide, linear, dark purple-brown, with rounded and somewhat emarginate apex, adnate to the outer corona at the raised sinuses between the lobes, obliquely ascending, somewhat incurved incumbent upon the anthers, connivent at their very apices.

C. deflersiana is closely allied to *C. sacculata* N.E. Br. from Southern Ethiopia, with which it shares the long-tubed corolla and the interesting outer corona which in both species is divided into five pouches. Our species, however, differs from its ally in that the corolla lobes are longer than the tube while in *C. sacculata* the reverse is the case. Moreover, in *C. deflersiana* the inner corona lobes are ascending and incurved, their apices just touching 1 mm. or so above the anthers, while in the older species the apices are erect.

Another closely related species is *C. tubiformis* Bruce et Bally from Northern Kenya. In this species, however, the lobes and upper portion of the tube are covered with long, white hairs, while the inner corona lobes are horizontally inflexed over the anthers.

It is felt that this plant differs sufficiently from its allies to be awarded specific rank. It is named in honor of Alfred Deflers, the great and intrepid French botanist, who travelled extensively in South Western Arabia towards the end of the 19th century. To him we owe almost all that is known of the botany of what is now the South Arabian Federation.

A beautiful species, *C. deflersiana* is conspicuous for the large size of its very dark flowers. The dome-shaped coronal structure is of particular interest. The pink outer corona is remarkable for the fact that the pouch-like dark purple-brown lobes are open laterally, while the sinuses between them are pointing upward and support the long, dark inner corona-lobes. This unusual corona is very beautiful.

Our species was collected on the 16 August 1962, 1 mile West of Lodar in the Audhali country of the Federation of Southern Arabia in a sandy plain. It was found growing in the shade of a fair-sized tree of *Acacia tortilis* (Forsk.) Hayne, near the fence surrounding the grounds of the Agricultural Research Station, in association with *Caralluma penicillata* (Defl.) N.E. Br., *Euphorbia cf. inarticulata* Schweinf., *Sansevieria ehrenbergii* Schweinf., *Cissus quadrangu-*

laris L. and *C. rotundifolia* (Forsk.) Vahl. The plants were in flower and specimens were preserved in liquid.

The species was also found on the plain five miles South of Lodar (Lavranos 1897 and 1904) where it is very common. It grows here in association with the same species as well as *Adenia venenata* Forsk, *Huernia* sp. (Lavranos 1900) *Duvalia sulcata* N.E. Br., *Jatropha lobata* (Forsk.) Muell., *Dipcadi tacazzeanum* (Hochst.) Bak., *Maerua* sp. and *Zygophyllum simplex* L.

C. deflersiana belongs to the *Ango* group of the genus.

2. **Caralluma hexagona** Lavranos, nov. sp. affinis *C. umbellatae* Haworth sed caulibus hexagonis, fasciculis florum sub-terminalibus, corollae textura, pilis ad apices loborum corollae fasciculatis discedit; affinisque *C. edithae* N.E. Br. sed caulibus brevibus, hexagonis, floribus majoribus, flavis, rubro-purpureis maculatis differens.

Caules conferti, ascendentes, glabri, virides vel glauco-virides, hexagoni vel rarius 5- vel 4-goni, angulis compressis, sinuato-dentatis, 3—5 cm. (tenus 8 cm.) longi, 15—20 mm. crassi; folia deltoidea, parva, viridia, mox decidua; flores 5—9 in fasciculis sub-apicalibus producti; pedunculi breves, cuspidati; bracteae lineares, minimae; pedicelli teretes, glabri, virides, ca. 10 mm. longi, 1·5 mm. diam.; sepala deltoidea, acuta, carinata, viridia, minute rubro-punctata, 2—3 mm. longa, basi 1 mm. lata; corolla rotata, tenus 22 mm. diam. inter apices loborum, extus albo-virens, maculis rubris, convexis, parvis punctata, intus flavescens, anguste rubro-purpurea marginata, ubique maculis rubro-purpureis, convexis, vernicosis dense induta, glabra; loborum apices pilis vibratilibus simplicibus, compressis, fuscis rubro-purpureis, 2 mm. longis, fasciculatis, induti; tubus brevis, 3 mm. longus, 6 mm. diam.; lobi deltoidei. acuti, tenus 8 mm. longi, basi tenus 8 mm. lati; corona exterior concava, fusca rubro-purpurea, tenus 6 mm. diam., lobis profunde bifidis, segmentis horizontaliter curvatis divergentibus, canaliculatis, puniceis marginatis; coronae interioris lobi breves, minusque 1 mm. longi, non conniventes, supra antheras horizontaliter incumbentes, lineares, punicei, apice truncato-emarginato, flavo.

Type Locality. South Western Arabia, South Arabian Federation, Audhali Plateau, 3 miles South of Al Madhan, on bare, rocky diabase hill, alt. appr. 7,500 ft. (2,250 metres), lat. 13° 58′ N., long. 45° 40′ E., collected in flower on 17 August 1962, fl. Johannesburg 10 January 1963, and Pretoria 26 February 1963 (Lavranos 1829: KEW, holotype; PRE, isotype).

Plant suckering in all directions and forming dense mats.

Stems ascending, 3—5 cm. (up to 8 cm.) long, 15—20 mm. thick, green or greyish-green, glabrous, six-angled or rarely 4- or 5-angled, angles compressed, sinuous-dentate.

Leaves small, deltoid, soon deciduous.

Flowers 5—9 mm., in fascicles just below the apex of young stems.

Peduncle cuspidate, short.

Bracts linear, short.

Pedicel terete, glabrous, green, appr. 10 mm. long, 1·5 mm. diam.

Sepals deltoid, acute, carinate, green with many minute red spots, 2—3 mm. long, 1 mm. broad at base.

Corolla rotate, up to 22 mm. diam. between apices of lobes; *outer surface* greenish-white with many small, red, wart-like spots but more so on the lobes; *inner surface* cream with a greenish tinge and a narrow, dark purple-red margin, densely covered throughout with dark purple-red, round, convex, vernicose spots, glabrous, except for a tuft of dark purple-red, simple, compressed, vibratile hairs, up to 2 mm. long at the apex of each lobe; *tube* short, appr. 3 mm. long, 6 mm. diam.; *lobes* deltoid, acute up to 8 mm. broad at base and as long.

Outer corona concave, dark purple-red, up to 6 mm. diam., the lobes deeply bifid, with horizontally diverging, canaliculate, curved segments which have a pink margin.

Inner corona lobes short, less than 1 mm. long, closely and horizontally incumbent upon the anthers, linear, pink with truncate-emarginate yellowish apices.

The closer affinities of this species are indeed rather difficult to determine. While it clearly belongs to the *Europaea-Umbellata* group, its six-angled stems serve to distinguish it from all other known species of that group. This character is, in itself, very unusual within the genus.

The flowers, as a composite entity, differ widely from those of all other known species.

The corolla, in shape and texture, closely resembles that of certain Stapeliae from Southern Africa and in particular the non-ciliate form of *Stapelia parvipuncta* N.E. Br., while the tufts of vibratile hairs borne at the apices of the corolla lobes are a character which our species shares with *C. edithae* N.E. Br., and *C. penicillata* (Defl.) N.E. Br., but the latter has a totally different corona.

The corona of *C. hexagona* has broadly the same general structure as the coronae of various species in the *Europaea-Umbellata* group with which it shares the deeply bifid outer corona lobes, but in our species these lobes are horizontally spreading, which is a character reminiscent of some species of *Trichocaulon*.

So far as I can judge, *C. hexagona* is most closely related to certain Indian species of the genus and in particular to some forms *C. umbellata* Haw. from Peninsular India but while it shares with these the form of the outer corona, it differs very much in habit, form of stems and in the texture of its corolla from this and all other known Asiatic species. Another related species is

PLATE XI.

Caralluma deflersiana Lavranos. The type plant, actual size. *Photograph: Division of Botany, Pretoria.*

PLATE XII.
Caralluma deflersiana Lavranos x2.
Photograph: Division of Botany, Pretoria.

PLATE XIII.
Caralluma solenophora Lavranos. A fascicle of flowers, x2.
Photograph: Division of Botany, Pretoria.

PLATE XIV—FIG. 1.
Caralluma hexagona Lavronas, x0·80.
Photograph: Division of Botany, Pretoria.

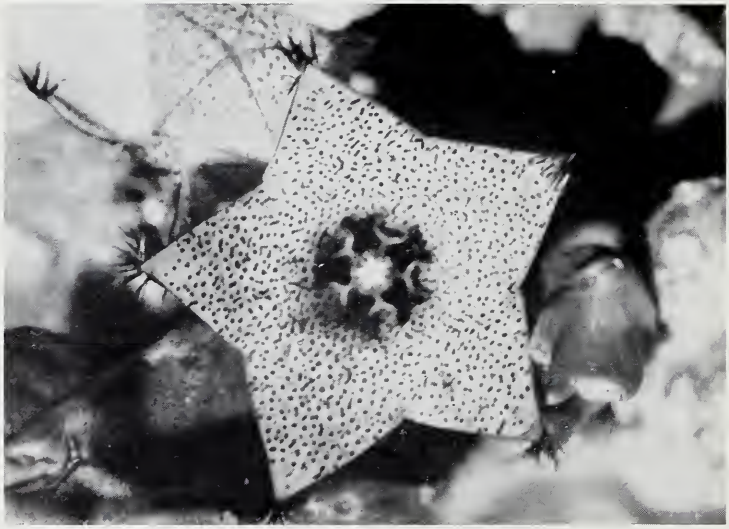

PLATE XIV—FIG. 2.
Caralluma hexagona Lavranos. A single flower, x3½.

C. edithae N.E. Br. from Northern Somalia which, however, is a large, shrubby plant with much smaller, uniformly dark-purple flowers, while the bifid outer corona lobes are erect. Our species differs, moreover, from all those above referred to by the fact that its umbels contain a much smaller number of flowers and are sub-terminal.

This unusual species was found on the Audhali Plateau (Kor al Audhilla) in the Federation of Southern Arabia, 3 or 4 miles South of the border of the Yemen on a bare, rocky hill consisting of diabase and metamorphic rocks, only a short distance from the village of Al Madhan. It appears to be rare and, despite a diligent search, only two plants were discovered.

Our plants were growing in association with *Caralluma quadrangula* (Forsk.) N.E. Br., *C. plicatiloba* Lavranos, *Senecio pendulus* (Forsk.) Sch. Bip., *S. anteuphorbium* (L.) Sch. Bip. var. *odorus* (Forsk.) Rowley, *Lantana subtracta* Hiern., *Barbacenia arabica* (Bak.) O. Schwartz, *Craterostigma plantagineum* Hochst. and a few other plants. They were in flower when collected and specimens were preserved in liquid.

Live plants sent to Johannesburg and the Division of Botany, Pretoria, flowered there on 10 January and 26 February 1963 respectively, when the present description was made possible.

3. **Caralluma solenophora** Lavranos, nov. sp. affinis *C. diffusae* (Wight) N.E. Br. sed habitu, marginibus loborum nusquam ciliatis tubo corollae longissimo, structura coronae, umbellis floralibus paucifloris differt; affinisque *C. penicillatae* (Defl.) N.E. Br., sed habitu, magnitudine florum, corolla tubata, structura coronae discedit.

Planta multiramosa, usque ad 20 cm. alta; Caules erecti vel adscendentes, ramosi, ramis minusque 8 cm. longis, 20 mm. crassis, tetragonis, glabris, viridibus, angulis compressis, dentibus obtusis, apice retrospicientibus; folia parva, deltoidea, mox decidua; flores 4—6, in fasciculis sub-apicalibus producti; pedunculi usque ad 5 mm. longi; bracteae lineares, acutae, 1—2 mm. longae; pedicelli teretes, glabri, ca. 6 mm. longi, 1·5 mm. diam.; sepala lanceolata, acuta, viridia, 4—5 mm. longa, basi 1 mm. lata; corolla longissime tubiformis, ca. 22 mm. longa, extus glabra, brunneo-flavescens, obscure in longitudinem lineata vel sulcata, intus basi tubi flavescens, fusco-purpurea punctata, deinde flava, confertim fusco-purpurea lineata, glabra, fusco purpurea marginata; tubus ca. 19 mm. longus, basi globosus, 9 mm. diam., superne a 6 mm. constrictus, deinde iterum per longitudinem 11 mm. 8 mm. latus, strictus; lobi patuli leviter deflexi, deltoidei, acuti, basi 7 mm. lati, 5—6 mm. longi, ad apices pilis fusco-purpureis, vibratilibus, simplicibus, complanatis, 1—2 mm. longis, fasciculatis induti; corona exterior cyathiformis, obtuse pentagona, ca. 5 mm.

diam. 4 mm. alta, extus verticaliter sulcata, margine sub-integro, fusco-purpurea; coronae interioris lobi, fusco-purpurei, ascendentes et supra antheras arcte incumbentes, 2 mm. longi et lati, basi lata in longitudinem bisulcati, marginibus parte media tangentibus, apice sub-quadrati, emarginati.

Type Locality. South Western Arabia, South Arabian Federation, Audhali Plateau, South of Mukeiras, on upper rocky western slope of Wadi Salul, lat. 13° 55′ N., long. 45° 40′ E., alt. apprx. 7,000 feet (2,100 metres); coll. in flower 18 Aug. 1962, fl. Pretoria 24 Jan. 1963 (Lavranos 1860: KEW, holotype; PRE, isotype).

Plant densely branched, up to 20 cm. high.

Stems erect or ascending, branched, the branches less than 8 cm. long, 20 mm. diam., 4-angled, glabrous, green or brownish-green, the angles compressed, the teeth rather obtuse with downward pointing apices.

Leaves small, deltoid, soon deciduous.

Peduncles raised, up to 5 mm. long.

Bracts linear, acute, 1—2 mm. long.

Pedicel terete, glabrous, appr. 6 mm. long, 1·5 mm. diam.

Sepals lanceolate, acute, green, 4—5 mm. long, 1 mm. broad at base.

Corolla very long tubiform, appr. 22 mm. long, outside glabrous, yellowish-brown, obscurely longitudinally lineate or sulcate, inside narrowly margined with dark purple-brown, creamy-yellow with dark purple-brown spots at base of tube, thereafter yellow, densely covered with narrow, irregular, transverse, dark purple bands, which become confluent towards the apices of the lobes, glabrous; *tube* appr. 19 mm. long, globose and 9 mm. diam. at base, becoming constricted to a diameter of appr. 6 mm., thereafter widening again abruptly to 8 mm. and remaining straight (cylindrical) for a length of 11 mm.; *lobes* spreading horizontally, somewhat reflexed, deltoid, acute, 7 mm. broad at base, 5—6 mm. long, glabrous, bearing at their apices a fascicle of dark purple, laterally compressed, simple, vibratile hairs, 1—2 mm. long.

Outer corona cupular, obtusely pentagonal with rounded angles, appr. 5 mm. diam., 3·5 mm. high, outside vertically furrowed, dark purple with a sub-entire margin.

Inner corona lobes dark purple, ascending and closely incumbent upon the anthers with two longitudinal furrows in their lower half and one down the middle of the apical portion, touching each other laterally in their middle section, appr. 2 mm. broad at base, 2 mm. long, narrowing abruptly at about half their length to appr. 1 mm. and terminated in sub-quadrate, emarginate apices.

C. solenophora, one of the most remarkable species in the Arabian section of the genus, belongs to the *Europaea-Umbellata* group, on account of the fact that it produces its flowers in sub-terminal umbels. Its affinities are other-

wise rather distant. They seem, broadly speaking, to point in the direction of certain species from India. Of these, *C. diffusa* (Wight) N.E. Br. appears to be closest to our species but differs from it by its much shorter, campanulate corolla-tube, in having ciliate corolla-lobes, in lacking the terminal tufts of vibratile hairs, in producing its many-flowered inflorescences at the very apices of the stems, and in having a rather different corona.

C. penicillata (Defl.) N.E. Br., from Southern Arabia and the Red Sea hills of Eritrea and the Sudan is another relative but has much smaller, rotate flowers produced in dense, lateral umbels and is, otherwise, a very large plant with sparsely branched stems reaching a height of 4 feet or even more. The structure of its corona is closer, however, to that of *C. solenophora* than that of any other known Caralluma.

It is interesting to note that, in *C. solenophora*, the inner corona lobes, which are adnate to the outer corona cup just below its rim, are in contact with each other laterally in their middle section just above the pollen masses while, between their bases, there is an opening by which access may be gained to the style.

C. solenophora is an altogether remarkable species both in the form of its flowers and in the structure of its corona. It was collected on the upper western slope of Wadi Salul, on the Audhali Plateau a few miles South of the village of Mukeiras near the edge of the escarpment, on 18 August 1962, by Major M. D. van Lessen, who accompanied Mr. Meintjes and me on several occasions while we were in that area.

The species was found growing on very rocky ground in association with *Euphorbia balsamifera* Ait. (syn. *E. adenensis* Defl.), *E. schimperi* Presl., *Aloe* sp. (Lavranos 1817), *Huernia marnieriana* Lavranos, *Echidnopsis* sp. (Lavranos 1848), *Dorstenia foetida* (Forsk.) Schweinf., *Adenium obesum* (Forsk.) R. et S., *Coleus barbatus* (Andr.) Benth., *Cotyledon barbeyi*, Schweinf., *Barleria* spp., *Acacia* spp. and various other plants. The plant found by Major van Lessen was in flower and a specimen was preserved in liquid.

C. solenophora seems to be a rather rare species in its habitat and we observed only three plants, although we spent several hours collecting in the area where it was first seen.

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SITOGENETIESE STUDIES IN DIE GENUS ORNITHOGALUM L.

I. INLEIDENDE OORSIG*

R. DE V. PIENAAR

(*Departement Erflikheidsleer, S.E. Landboukollege,*

Universiteit van Stellenbosch)

(Met Plate XV—XXI)

SAMEVATTING

Die chromosoomaantalle van dertig van die bekendste Suid-Afrikaanse Ornithogalum spesies (tjienkerientjees) is getabuleer en hulle idiogramme uitgebeeld. 'n Oorsig is gelewer van die kariotipes verhoudelik tot die taksonomie van die genus en die vasstelling van spesiesverwantskappe; die monosporiese Polygonum-tipe van kiemsakontwikkeling by *O. thyrsoides* Jacq. en *O. virens* Lindl.; en die resultate van geïnduseerde poliploïdie, inter- en intraspesieskruisings. Die voorkoms van introgressiewe verbastering, sitoplasmiese manlikonvrugbaarheid, en selfonverenigbaarheid in die genus *Ornithogalum* is aangemeld.

ABSTRACT

The chromosome numbers of thirty South African species including hundred and twenty forma, varieties, and ecotypes of *Ornithogalum* are listed and the idiogrammes of the most important types are illustrated. A review is given of the karyotypes and the genetic relationship between species, the results of polyploidisation, inter- and intraspecific hybridization, and the monosporic Polygonum-type of embryo sac development in *O. thyrsoides* Jacq. and *O. virens* Lindl. Examples are given of the occurrence of introgressive hibridisation, cytoplasmic male sterility and selfincompatability in the genus *Ornithogalum.*

INLEIDING

Die ontwikkeling van die biosistematiek waarin veral klem op populasiestudies en die gebruik van sitologiese en genetiese metodes gelê word, het 'n geweldige invloed op die taksonomie gehad en van groot nut geblyk om die evolusiegeskiedenis en verwantskappe van baie plante te bepaal. Hierdie eksperimentele taksonomie wat nie net van die gewone morfologiese en anatomiese eienskappe gebruik maak nie, maar ook uit ondersoeke oor fisiologiese gedrag, variërende ekologiese toestande, geografiese verspreiding, embriologiese ontwikkeling, serologiese wisselwerkings, biochemiese samestelling en veral uit

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sitologiese kenmerke en die sitogenetika van hibriede getuienis put, streef om die werklike aard van die taksa en hul onderlinge verwantskappe uiteen te sit. Weens gebrek aan ruimte kan 'n uiteensetting van die biosistematiese, eksperimenteeltaksonomiese en geen-ekologiese bevindings, konsepte, en terminologiese definisies nie hier gegee word nie, en daar word in dié verband na die werke van Anderson, Avdulov, Babcock, Clausen, Darlington, Dobzhansky, Goodspeed, Gustafsson, Kihara, Lewis, Löve, Sears, Stebbins, Turesson, e.a., wat in die meegaande bibliografie aangegee is, verwys. Uit al hierdie werke is dit duidelik dat veral sitologie en sitogenetika van besondere belang is om die probleme in die taksonomie en evolusie te help oplos, maar dat die bevindings van die ander studierigtings ook geraadpleeg moet word aleer enige beslissende gevolgtrekkings getref kan word. Heelwat informasie met betrekking tot die verwantskappe tussen die taksonomiese taksa: spesies, subspesies, variëteite en forma, of om die biosistematiese kategorieë van senospesies, ekospesies en ekotipe te gebruik, is uit 'n vergelykende studie van hulle chromosome, veral ten opsigte van hulle aantal en morfologie verkry, want dit is waargeneem dat evolusionêre ontwikkeling dikwels gepaard gaan met veranderings in die chromosoomaantal en -morfologie. Die mate van strukturele homologie tussen die chromosome van die verskillende taksa kan verder veral uit die meiotiese paringskonfigurasies in die hibriede se sporosiete afgelei word.

Die genus *Ornithogalum* L. waaraan die bekende tjienkerientjee, *O. thyrsoides* Jacq. behoort, word geklassifiseer onder die tribus Scilleae van die familie Liliaceae. Die genus is van aansienlike ekonomiese belang vir die tuinboubedryf want sedert ongeveer vyf-en-twintig jaar gelede is 'n sterk uitvoermark vir die blomme en bolle van *O. thyrsoides* en *O. lacteum* in Europa en Amerika opgebou. Aan die anderkant moet sorg gedra word dat plantmateriaal van hierdie soorte nie saam met hooi gemeng raak nie, want dit is bekend dat dit die dood van vee veroorsaak het. *Ornithogalum* is 'n besonder groot genus en volgens die Index Kewensis (uit Leighton, 1944) kom daar ongeveer 245 spesies oor die wêreld voor waarvan 120 alleen in Suid-Afrika, insluitende Suidwes Afrika, aangetref word.

In haar taksonomiese hersiening van die Suid-Afrikaanse *Ornithogalum* spesies, onderskei Leighton (1944, 1945) 80 verskillende soorte. Die grootste konsentrasie van spesies kom inderdaad in Suid-Afrika, en wel in die Kaapprovinsie, voor, en volgens Feinbrun (1941) het die genus alhier ontstaan en in die vroeë tertiêre tydperk voor die skeiding van Afrika en Suid-Amerika, na die ander wêrelddele versprei, veral na die Mesogene koninkryk waar die tweede groot sentrum van spesiesontwikkeling plaasgevind het.

Daar die genus so groot en wyd versprei is, is dit te verstane dat dit besonder baie taksonomiese probleme oplewer. Sommige taksa is veral moeilik om te onderskei en dit is ondervind dat materiaal vanaf dieselfde plant wat op ver-

skillende tye aan taksonome voorgelê is, identifiseer is as behorende aan twee of selfs drie spesies. Alhoewel Leighton (1944, 1945) se klassifikasiesleutel baie kunsmatig is en tot 'n groot mate baseer is op eienskappe wat by die verskillende ekotipes taamlik varieer (bv. die morfologie van die meeldrade) en sodoende oorvleueling veroorsaak, is dit nogtans die enigste basis waarop 'n sitotaksonomiese ondersoek gebou kan word.

Sitologiese en sitotaksonomiese studies is reeds voorheen met Ornithogalum gedoen (sien verwysings in Darlington en Wylie, 1955; Neves, 1952). In dié verband kan veral die monumentele werk van Neves (1950, 1952, 1953, 1956) hoofsaaklik op Europese spesies, en dié van De Wet (1957) op die Suid-Afrikaanse spesies, genoem word. Soos uit Tabel I blyk, stem De Wet se bevindings, wat op mikrotoomsnitte van wortelpunte baseer is, in baie gevalle nie ooreen met die huidige nie. 'n Paar spesies se chromosoomaantalle is nie alleen verskillend nie, maar volgens De Wet se idiogramme van die verskillende spesies is al die chromosome metasentries of submetasentries, terwyl die huidige ondersoek aangetoon het dat die chromosome van meeste spesies inderdaad akrosentries is, met die kort arm gewoonlik besonder klein (Plate XV, XVI en XVII). In hierdie lig gesien, moet die akkuraatheid van De Wet se bevindings in twyfel getrek word.

Materiaal en Metodes

Plante van soveel taksa (spesies, forma, ekotipes, ens.) as moontlik is oor die hele Suid-Afrika, en veral die Kaapprovinsie, versamel en in potte geplant. Die identifikasie van die plante is in oorleg met die taksonome van die Compton Herbarium, Kirstenbosch, en in navolging van Leighton (1944, 1945) se klassifikasiesleutel en beskrywings gemaak. Die sitologiese ondersoek is met behulp van die Leuko-basiese-fuksien-papdruk tegniek, soos deur Pienaar (1955) beskryf, gedoen, aangesien dit baie sekuurder studies moontlik maak as die mikrotoomsnitmetode. Die kariotipes waarvan die idiogramme saamgestel is, is aanvanklik teen 'n vergroting van 4000× geteken met behulp van 'n Carl Zeiss mikroskoop wat toegerus is met die nuwe tipe Carl Zeiss tekenapparaat. Gewoonlik is 'n aantal C-metafase plate van ten minste drie plante bestudeer voordat die idiogram saamgestel is. Die fotos is geneem en afgedruk soos beskryf in Pienaar (1955).

Bevindings

Die chromosoomaantalle van die verskillende spesies, gerangskik volgens Leighton (1944, 1945) se klassifikasiesleutel, word in Tabel I aangegee. Die idiogramme van sommige spesies word in meegaande Plate XV, XVI en XVII illustreer.

TABEL 1

Die chromosoomaantalle van Suid-Afrikaanse Ornithogalumsoorte, gerangskik volgens Leighton (1945) se klassifikasiesleutel.

Spesies volgens Leighton (1944, 1945)	2n aantal	Herkoms of versamelplek	Vorige bevindings
O. miniatum Jacq.	12	Assegaaibosch, Vanwyksdorp	12: De Wet (1957)
(Oranjekleurige tipe)	12	Brandwag, Worcester	
,,	12	Caledon	
,,	12	De Wet, Worcester	
,,	12	Humansdorp	
,,	12	Klipdale	
,,	12	Koo	
,,	12	Skerpioenheuwel, Worcester	
,,	12	Tulbagh	
,, v. vandermerwei	12	Riviersonderend	
O. miniatum Jacq. (Wit en room tipes)	12	Barrington	
,,	12	Bloukrans	
,,	12	Harkerville	
,,	12	Karatara	
,,	(24)	Karatara	
,,	12	Kruisfontein	
,,	12	Montagu	
,,	12	Ruiterbosch	
O. fergusoniae L. Bolus	12	Kruisfontein	
O. flavissimum Jacq.	12	De Rust, Oudtshoorn	12: De Wet (1957)
,,	(12 + 5B)	De Rust, Oudtshoorn	
,,	12	Keurboomsrivier	
,,	12	Prins Alfred-pas	
,,	12	Riviersonderend	
,,	12	Robberg	
,,	12	Stanford	
,,	12	Cultivar ex John Innes	
O. ceresianum Leighton	12	Swaarmoedpad, Ceres	
O. hermannii Leighton	12	Hopefield	
,,	12	Citrusdal	
,,	12	Moorreesburg	
O. alticolum Leighton	12	Bredasdorp	12: De Wet (1957)
,,	12	Bredasdorp—Klipdalepad	
,,	12	Caledon	
,,	12	Ceres	
,,	12	Lindeshof	
,,	12	Swellendam	
O. leipoldtii L. Bolus	12	Citrusdal—Clanwilliampad	10: De Wet (1957)
,,	12	Ex Botaniese Tuin, Stellenbosch	
,,	12	Pakhuispas, Clanwilliam	
,,	12	Van Rhynsdorp	
O. lacteum Jacq.	12	Aurora, Piketberg	32: Sato (1942), Namajima (1936)
,,	12	Darling	12: De Wet (1957)

TABEL 1

Die chromosoomaantalle van Suid-Afrikaanse Ornithogalumsoorte, gerangskik volgens Leighton (1945) se klassifikasiesleutel.

Spesies volgens Leighton (1944, 1945)	2n aantal	Herkoms of versamelplek	Vorige bevindings
,,	12	Elandsbaai	
,,	12	Pakhuispas, Clanwilliam	
O. lacteum forma β Leighton	12	Grahamstad	
O. lacteum forma	10	Calvinia	
,,	10	Sutherland	
O. fimbrimarginatum Leighton	12	Haelhoeksneeukop, Du Toitskloof	
,,	(18)	Jan du Toitskloof	
O. pruinosum Leighton	12	Kamieskroon, Lokaliteit 1	
,,	12	Kamieskroon, Lokaliteit 2	
,,	12	Loeriesfontein	
,,	12	Roggeveld, Calvinia	
,,	12	Van Rhynsdorp	
O. thyrsoides Jacq.	12	Bokbaai	12: Neves (1953)
,,	12	Ceres	12: De Wet (1951)
,,	12	Citrusdal	
,,	12	Clanwilliam	
,,	12	Darling	
,,	12	Durbanville	
,,	12	Elsenburg	
,,	12	Gordonsbaai	
,,	12	Heidelberg	
,,	12	Jonkershoek	
,,	12	Kirstenbosch	
,,	12	Kruisfontein	
,,	12	Laingsburg	
,,	12	Leipoldtville	
,,	12	Malmesbury	
,,	12	Mamre—Bokbaaipad	
,,	12	Paleisheuwel	
,,	12	Porterville	
,,	12	Sandveld	
,,	12	Swellendam	
,,	12	Stellenbosch	
,,	12	Welgevallen, Stellenbosch	
,,	12	Wellington	
O. thyrsoides forma η Leighton	12	Calvinia	
,,	12	Kamieskroon	
,,	12	Springbok	
,,	12	Vredendal	
O. thyrsoides forma L	12	Alexandria	
O. thyrsoides forma L Leighton	12	Grahamstad Lokaliteit 1	
,,	12	Grahamstad Lokaliteit 2	

TABEL 1

Die chromosoomaantalle van Suid-Afrikaanse Ornithogalumsoorte, gerangskik volgens Leighton (1945) se klassifikasiesleutel.

Spesies volgens Leighton (1944, 1945)	2n aantal	Herkoms of versamelplek	Vorige bevindings
,,	12	Grahamstad Lokaliteit 3	
,,	(18)		
,,	12	Prins Albert	
O. thyrsoides cultivar	12	Pietermaritzburg	
,,	12	Port Elizabeth	
O. thyrsoides dubbelblom cultivar	18	Ex Botaniese Tuin, Stellenbosch	
O. conicum Jacq.	12	Ex Botaniese Tuin, Stellenbosch	
,,	12	Houthoek, Sutherland	
,,	12	Nieuwoudtville	
O. conicum var. strictum Leighton	12	Clanwilliam	
O. synanthifolium Leighton	12	Umtata	12: De Wet (1957)
O. ranunculoides L. Bolus	12	Kamieskroon	
,,	12	Brandewynsbank, Okiep	
O. maculatum Jacq.	12	Clanwilliam	14: De Wet (1957)
,,	12	Touwsrivier	
,,	12	Tulbaghkloof	
	(24)	Tulbaghkloof	
O. maculatum var. speciosum (Bak.)	12	Garies	14: De Wet (1957)
O. maculatum var. speciosum (Bak.) Leighton	12	Kamieskroon, Lokaliteit 1	
,,	12	Kamieskroon, Lokaliteit 2	
,,	12	Nieuwoudtville	
,,	12	Springbok	
O. maculatum var. splendens (L. Bolus) Leighton	12	Roggeveld, Calvinia	14: De Wet (1957)
O. marlothii Leighton	24	Springbok	
O. hispidum Hornem.	20	Jonkershoek	
O. attenuatum Leighton	12	Paleisheuwel	
O. graminifolium Thumb.	12	Jonkershoek	
O. leptophyllum Bak.	12	Witwatersrand	
O. subulatum Bak.	10	Grahamstad	
O. virens Lindl.	6	Lourenço Marques	6: Quintanihla & Cabral. (1947); Weyers & Reusch (1952)
O. setifolium Kunth	8	Heuningneskloof, Fauresmith	8, 12: De Wet (1957)
O. caudatum Jacq.	18	Pietermaritzburg	54: Neves (1956) 54: Therman (1951) 32–36: Heitz (1926)
O. pretoriense Bak.	12	Witwatersrand	50: De Wet (1957)

TABEL 1

Die chromosoomaantalle van Suid-Afrikaanse Ornithogalumsoorte, gerangskik volgens Leighton (1945) se klassifikasiesleutel.

Spesies volgens Leighton (1944, 1945)	2n aantal	Herkoms of versamelplek	Vorige bevindings
O. ecklonii Schlecht.	10	Ex Botaniese Tuin, Stellenbosch	10: Therman (1951); Person (1959) as *O. graminifolium*
	10	Ex John Innes Hort. Inst.	12: De Wet (1957)
O. flavovirens Bak.	10	Grahamstad	
O. prasinum Lindl.	16	Heuningneskloof, Fauresmith	12, 14: De Wet (1957)
O. saundersiae Bak	14	Nelspruit	12: De Wet (1957)
,,	14	Ex Kirstenbosch	

Weens gebrek aan ruimte kan 'n volledige uiteensetting van die bevindings nie hier gegee word nie, en moet daar volstaan word met die mededeling dat die meeste ondersoekte spesies 'n somatiese chromosoomaantal van 12 het, wat blykbaar die primitiewe diploïedeaantal is.

Die O. miniatum-maculatum groep se haploïde komplement van $x=6$ bestaan basies uit vier lang chromosome, 'n medium lange, en 'n korterige chromosoom. Die grootte van 'n spesies of ekotipe se chromosome kan egter verskillend wees van dié van 'n ander, en die grootte van die kort arms, asook die posisie van die sekondêre insnoerings, het kariotipiese verskille tot gevolg (sien Plate XV, XVI en XVII). Die algemene ooreenkoms in hierdie groep se kariotipes word gerugsteun deur die feit dat meiotiese sinapse by 'n aantal interspesies-hibriede grotendeels normaal is. Die enigste noemenswaardige kariotipiese afwyking in hierdie groep is dié van *O. lacteum forma* vanaf Calvinia en Sutherland met $2x = 10$. Hierdie senospesies wat inderdaad glad nie met enige van die ander *O. lacteum* ekotipes kruis nie en as sodanig as 'n volwaardige spesies beskou kan word (in navolging van Dobzhansky, 1951, bl. 262, se definisie van 'n spesies) se kariotipe, het blykbaar uit die primitiewe tipe ontstaan deur middel van 'n sentriese vereniging (as gevolg van 'n translokasie) tussen twee lang akrosentriese chromosome (waarskynlik chromosome 1 en 4) aangesien een van die haploiede stel se chromosome byna tweekeer so lank is as die normale lang chromosome en daarby metasentries is. Dit is 'n uitsonderlike verskynsel by plante volgens Swanson (1957) en word hoofsaaklik by diere aangetref waar dit 'n belangrike rol in die evolusie van die kariotipe speel.

Ander kariotipiese bevindings waarop die aandag gevestig kan word, is:

(*a*) Die besondere ooreenkoms tussen die idiogramme van die verskillende biotipe van *O. miniatum* en wel beide oranje en wit tipes;

(*b*) die ooreenkoms tussen die idiogramme van *O. miniatum*, *O. fergusoniae* en *O. flavissimum*, wat gerugsteun word deur die kruisings en sitogenetiese bevindings (sien hieronder) en dus Leighton (1944) se vermoede staaf dat hulle net een spesies saamstel;

(*c*) dat *O. ceresianum* se kariotipe meer ooreenstem met dié van *O. thyrsoides* as met dié van *O. flavissimum* of *O. hermannii* waarmee dit in Leighton (1944, 1945) se sleutel saamgegroepeer is—kruisings het inderdaad ook aangetoon dat *O. thyrsoides* en *O. ceresianum* besonder kruisvrugbaar is;

(*d*) dat alhoewel *O. hermannii* en *O. thyrsoides* besonder kruisvrugbaar is (sien hieronder) hulle idiogramme effens van mekaar verskil;

(*e*) dat daar tussen die Caledon biotipe van *O. alticolum* aan die een kant en die Ceres en Swellendam biotipes aan die ander kant, groter kariotipiese verskille voorkom as tussen sommige spesies;

(*f*) dat die idiogram van *O. lacteum forma β* van Grahamstad meer ooreenstem met dié van *O. synanthifolium* van Umtata as dié van die ander *O. lacteum* biotipes;

(*g*) dat daar 'n taamlike variasie voorkom (alhoewel op 'n klein skaal) tussen die idiogramme van die verskillende *O. thyrsoides* ekotipes;

(*h*) dat *O. ranuculoides* en *O. maculatum* se kort chromosoom metasentries of effens submetasentries is in teenstelling met die ander soorte waar dit akrosentries is;

(*i*) dat *O. maculatum* se langste chromosoom (chromosoom 1) se kort arm 'n lang sekondêre insnoering of SAT-streek tussen die sentromeer en die satelliet bevat, terwyl die ander spesies een, twee of selfs drie sekondêre insnoerings aan die punte van die lang arms het;

(*j*) dat bogemelde veranderings relatief klein morfologiese en kariotipiese veranderings daarstel en daar dus, uitgesonderd die *O. lacteum* forma van Sutherland min groot chromosoomveranderings tydens spesiesevolusie in hierdie groep plaasgevind het.

Alhoewel sporadiese triploiede en tetraploiede plante in sommige andersins diploiede populasies waargeneem is (*O. miniatum*, *O. fimbrimarginatum*, en *O. thyrsoides forma l.*) en die gevolg is van die vorming van diploiede gamete wat veral aansienlik kan wees in die geval van die stuifmeelkorrels (sien ook Tabel II), het poliploïdie ín die O. miniatum-maculatum groep geen belangrike rol in die evolusionêre ontstaan van 'n spesies gespeel nie. Die bevinding van De Wet (1957) dat *O. miniatum* Jacq. var. *vandermerwei* Leighton tetraploied is kan dus nie sonder meer aanvaar word nie, veral daar dit nie bekend is hoeveel plante ondersoek is nie; 'n aantal plante wat waarskynlik aan hierdie variëteit

behoort, is op die proefplaas Tygerhoek, Riviersonderend, versamel, en hulle het almal 'n chromosoomaantal van 2x = 12 gehad. Inderdaad is dusver net een duidelike geval van poliploïdie by *Ornithogalum* aangetref en wel by *O. marlothii* wat aan die O. marlothii-subulatum groep van spesies behoort. Dit het vier stelle van die basiese chromosoomaantal van 6 in die somatiese selle, maar die chromosome is heelwat kleiner as by die ander spesies.

Die groep O. marlothii-subulatum word ook gekarakteriseer deur 'n basiese aantal van x = 6 (Tabel I, Plaat XVII), maar by *O. subulatum* Bak. met 2x = 10 en *O. hispidum* Hornem. met 2n = 20 het aneuploïdie en poliploïdie 'n rol by spesiesvorming gespeel. By *O. hispidum* het die kort chromosome verlore gegaan voor of na poliploïdie plaasgevind het. *O. graminifolium* Thunb. het 12 en nie 10 somatiese chromosome soos Therman (1951) en Person (1959) aangegee het nie; die plant wat hulle ondersoek het, behoort inderdaad nie aan hierdie spesies nie, maar wel aan *O. ecklonii* Schlecht.

In die groep O. virens-prasinum kom verskeie somatiese aantalle voor en varieer van 6 tot 18 (tot 54 volgens Neves, 1956). Aneuploïdie of translokasies, en poliploïdie het skynbaar 'n belangrike rol in die groep se evolusionêre divergensie gespeel. Behalwe *O. prasinum* wat 6 lang chromosome in die haploiede genoom het, besit die ander spesies almal net 3 lang chromosome en 'n variërende aantal van x = 6 (Tabel I, Plaat XVII), maar by *O. subulatum* Bak. met 2x = 10 genetiese belang te wees. *O. prasimum* (2n = 16) kan dus moontlik 'n poliploied wees, alhoewel die chromosoomaantal as sodanig nie daarop dui nie, terwyl *O. caudatum*—Pietermaritzburg biotipe—(2n = 18) egter 'n diploied is. Soos hieronder aangedui is onder die sitogenetika van die hibriede (sien ook Plaat V) word mutlivalente translokasiekomplekse gevorm wat daarop dui dat translokasies 'n rol gespeel het by die ontstaan van sommige kariotipes. Die chromosoom- en chromatiedbrûe tydens MI dui ook op inversies.

'n Laaste groep waarvan *O. saundersiae* Bak. die enigste bestudeerde voorbeeld is, is nie net morfologies verskillend van die vorige groepe nie, maar ook kariotipies. Dit is die spesies waarin die langste chromosome voorkom.

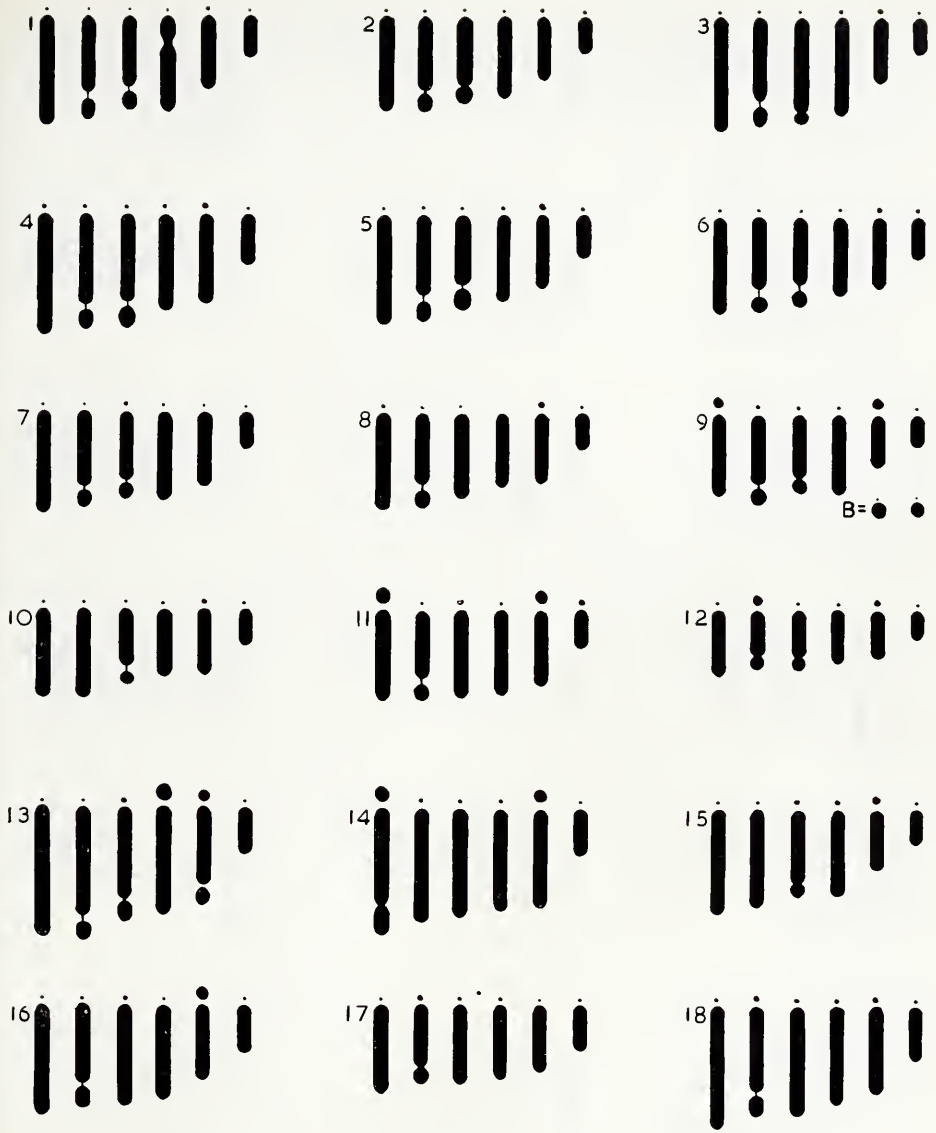
Hierdie vier groepe waarvan die eerste, nl. die O. miniatum-maculatum groep, ooreenstem met die seksie Caruelia (Parl.) van Bentham en Hooker, terwyl die O. virens-prasinum groep weer in hulle seksie Beryllis (Salisb.) val, word verder gekarakteriseer deur die feit dat kruisings tussen spesies wat aan verskillende groepe behoort nie moontlik is nie.

Ten einde verdere gegewens m.b.t. die verwantskappe tussen spesies in te samel, is reeds 4,763 verskillende inter- en intraspesieskruisings, terugkruisings, dubbelkruisings en selfbestuiwings tot op hede gemaak. Die belangrikste F_1 hibriede wat hieruit verkry is en tot blom gekom het, word in Tabel II opgesom. Dit is waargeneem dat die voorkoms van die stuifmeelkorrels wat met 1 : 1

TABEL 2

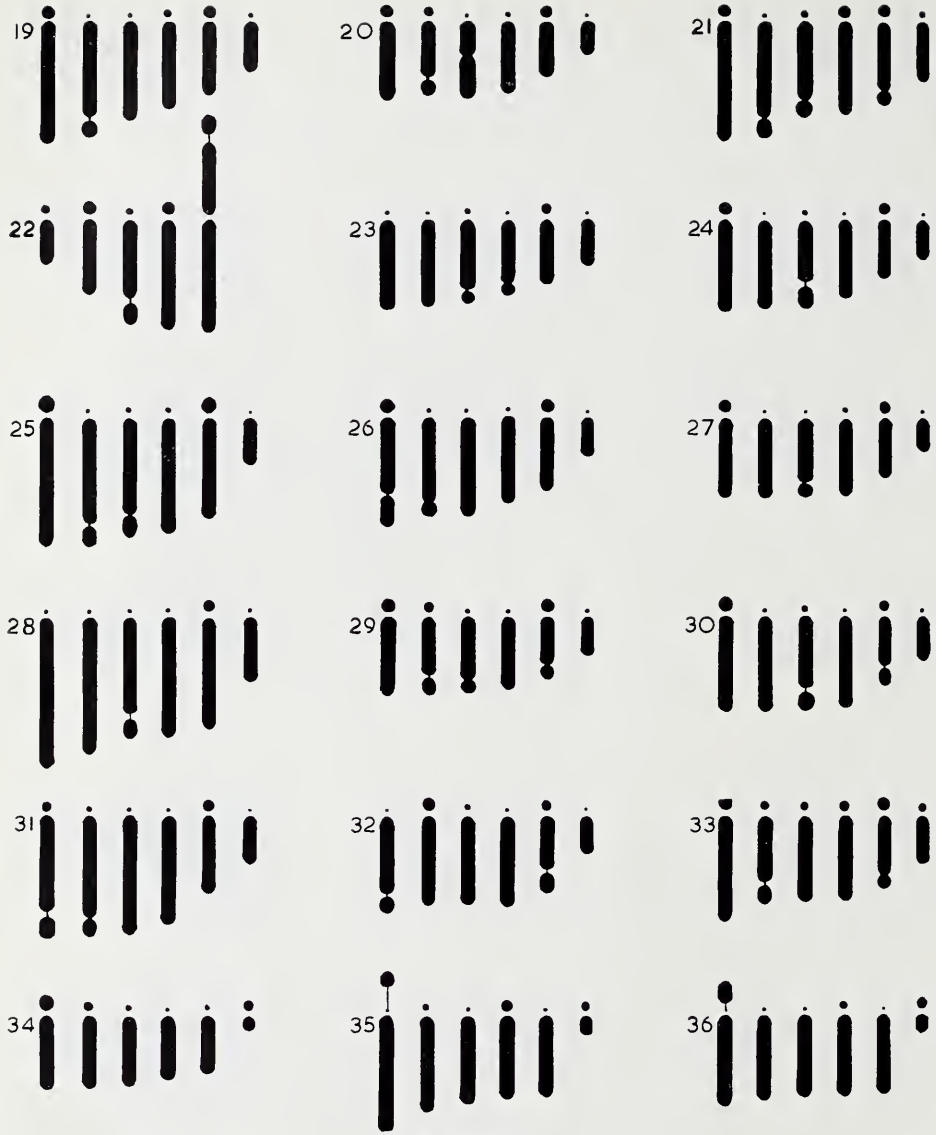
Die belangrikste ornithogalum inter- en intraspesies hibriede en die voorkoms van hul met Gliserol-asynkarmyn-gekleurde stuifmeelkorrels.

Vroulike Spesiesouer	Manlike Spesiesouer	Hibried Nr.	Voorkoms van Stuifmeelkorrels
O. alticolum Bredasdorp	O. fimbrimarginatum Haelhoek-sneeukop	640	Meestal dowwe korrel net 'n paar normale korrels.
O. alticolum Bredasdorp	O. flavissimum Ex John Innes Hort. Inst.	234	Baie min normale korrels.
O. alticolum Bredasdorp	O. flavissimum Touwsrivier	221	Min vrugbare korrels.
O. alticolum Bredasdorp	O. flavissimum Stanford	230	Min normale korrels waarvan baie 2x is.
O. alticolum Bredasdorp	O. flavissimum Prins Alfredpas	648	Minder as 50% normale korrels.
O. alticolum Bredasdorp	O. miniatum (oranje) Albertinia	233	Ongeveer 50% normale korrels.
O. alticolum Bredasdorp	O. thyrsoides Bokbaai	1163	Minder as 50% normale korrels.
O. alticolum Caledon	O. fergusoniae Kruisfontein	653	Minder as 50% normale korrels.
O. conicum Ex Bot. Tuin, Stellenbosch	O. thyrsoides Bokbaai	387	Net 'n paar normale korrels waarvan meeste 2x is.
O. conicum Ex Bot. Tuin, Stellenbosch	O. thyrsoides cultivar Port Elizabeth	388	Net 'n paar normale korrels wat 2x is.
O. conicum var. strictum Ex Bot. Tuin, Stellenbosch	O. lacteum Darling	390	Feitlik geen normale korrels nie.
O. fergusoniae Kruisfontein	O. alticolum Caledon	533	Minder as 50% normale korrels.
O. fergusoniae Kruisfontein	O. fimbrimarginatum Haelhoek-sneeukop	531	Baie min normale korrels.
O. fergusoniae Kruisfontein	O. miniatum (oranje) Caledon	535	Ongeveer 50% normale korrels.
O. flavissimum Harkerville	O. miniatum (oranje) Caledon	515	Minder as 50% normale korrels.
O. flavissimum Ex John Innes Hort. Inst.	O. flavissimum De Rust	156	?
O. flavissimum Ex John Innes Hort. Inst.	O. flavissimum Touwsrivier	157	?
O. flavissimum Ex John Innes Hort. Inst.	O. leipoldtii Ex Bot. Tuin, Stellenbosch	19	Minder as 50% normale korrels.
O. flavissimum John Innes Hort. Inst.	O. miniatum (oranje) Riversdal	154	
O. flavissimum Prins Alfredpas	O. fimbrimarginatum Haelhoek-sneeukop	423	Minder as 50% normale korrels.
O. flavissimum Prins Alfredpas	O. flavissimum Stanford	116	?
O. flavissimum Prins Alfredpas	O. leipoldtii Ex Bot. Tuin, Stellenbosch	419	Minder as 50% normale korrels.
O. flavissimum Prins Alfredpas	O. miniatum (oranje) Humansdorp	115	?
O. flavissimum Prins Alfredpas	O. miniatum (oranje) Tulbagh	424	Ongeveer 50% normale korrels.
O. flavissimum Robberg	O. fergusoniae Kruisfontein	1127	Feitlik 100% normale korrels.
O. flavissimum Robberg	O. miniatum (oranje) Caledon	1117	Feitlik 100% normale korrels.
O. flavissimum Robberg	O. miniatum (oranje) Van Wyksdorp	1118	Fietlik 100% normale korrels.
O. flavissimum Stanford	O. alticolum Bredasdorp	151	Feitlik geen normale korrels.
O. flavissimum Stanford	O. fergusoniae Kruisfontein	461	Minder as 50% normale korrels.
O. flavissimum Stanford	O. miniatum (oranje) Humansdorp	149	?
O. flavissimum Villiersdorp	O. thyrsoides forma η Springbok	1047	Min normale korrels.
O. lacteum Darling	O. fergusoniae Kruisfontein	362	Geen normale korrels.
O. lacteum Darling	O. flavissimum Villiersdorp	1045	Enkele normale korrels met reuse grootte.
O. leipoldtii Ex Bot. Tuin, Stellenbosch	O. alticolum Caledon	1603	Taamlik baie dowwe korrels.
O. leipoldtii Ex Bot. Tuin, Stellenbosch	O. flavissimum Robberg	1608	Net enkele normale korrels.
O. miniatum (wit) Bloukrans	O. fimbrimarginatum Haelhoek-sneeukop	920	Baie min normale korrels.
O. miniatum (wit) Bloukrans	O. thyrsoides forma L Prins Albert	921	Feitlik 100% normale korrels.
O. miniatum (oranje) Bredasdorp—Klipdale	O. alticolum Bredasdorp	174	Minder as 50% normale korrels.
O. miniatum (oranje) Caledon	O. thyrsoides forma L Grahamstad	1140	Feitlik 100% normale korrels.
O. miniatum (wit) Karatara	O. alticolum Caledon	948	Minder as 50% normale korrels.
O. miniatum (wit) Karatara	O. fergusoniae Kruisfontein	952	?
O. miniatum (wit) Karatara	O. fimbrimarginatum Haelhoek-sneeukop	959	Baie min normale korrels.
O. miniatum (wit) Karatara	O. miniatum (oranje) Van Wyksdorp	954	Min dowwe korrels—meestal normaal.
O. miniatum (wit) Karatara	O. thyrsoides Laingsburg	958	Ongeveer 50% normale korrels.
O. miniatum (wit) Ruiterbosch	O. thyrsoides forma L Grahamstad	976	Feitlik 100% normale korrels 2x korrels volop.



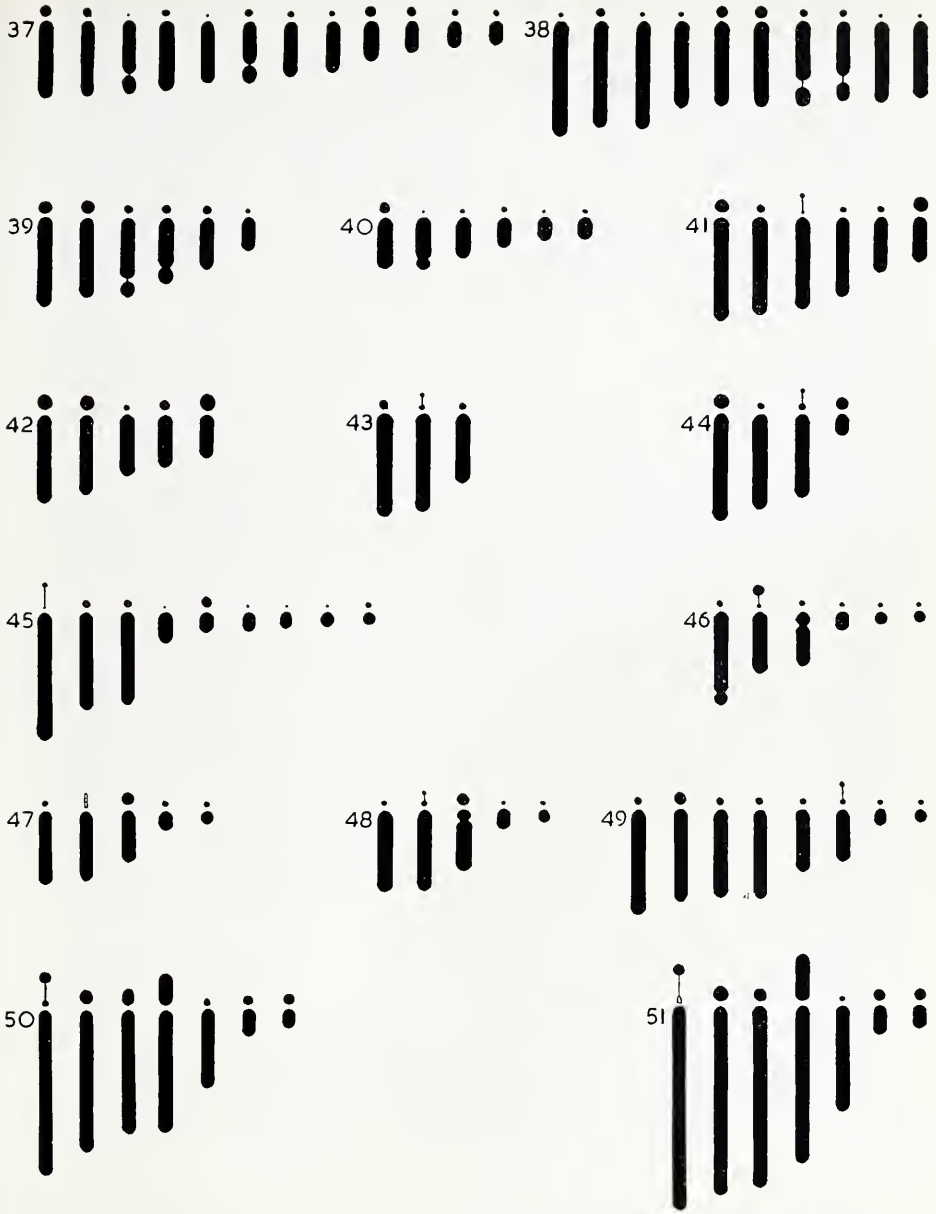
PLAAT XV.

Idiogramme van die haploïede chromosoomkomplemente van verskillende Ornithogalum spesies: (1) *O. miniatum* (oranje), Humansdorp; (2) *O. miniatum* (oranje), Montagu; (3) *O. miniatum* (oranje), Tulbagh; (4) *O. miniatum var. vandermerwei* (geel), Riviersonderend; (5) *O. miniatum* (wit), Montagu; (6) *O. miniatum* (wit), Ruiterbosch; (7) *O. fergusoniae*, Kruisfontein; (8) *O. flavissimum*, Robberg; (9) *O. flavissimum*, De Rust; (10) *O. flavissimum*, Stanford; (11) *O. ceresianum*, Ceres; (12) *O. hermanuii*, Citrusdal; (13) *O. hermannii*, Moorreesburg; (14) *O. alticolum*, Caledon; (15) *O. alticolum*, Ceres; (16) *O. alticolum*, Swellendam; (17) *O. leipoldtii*, Clanwilliam; (18) *O. leipoldtii*, Pakhuispas (x3000).



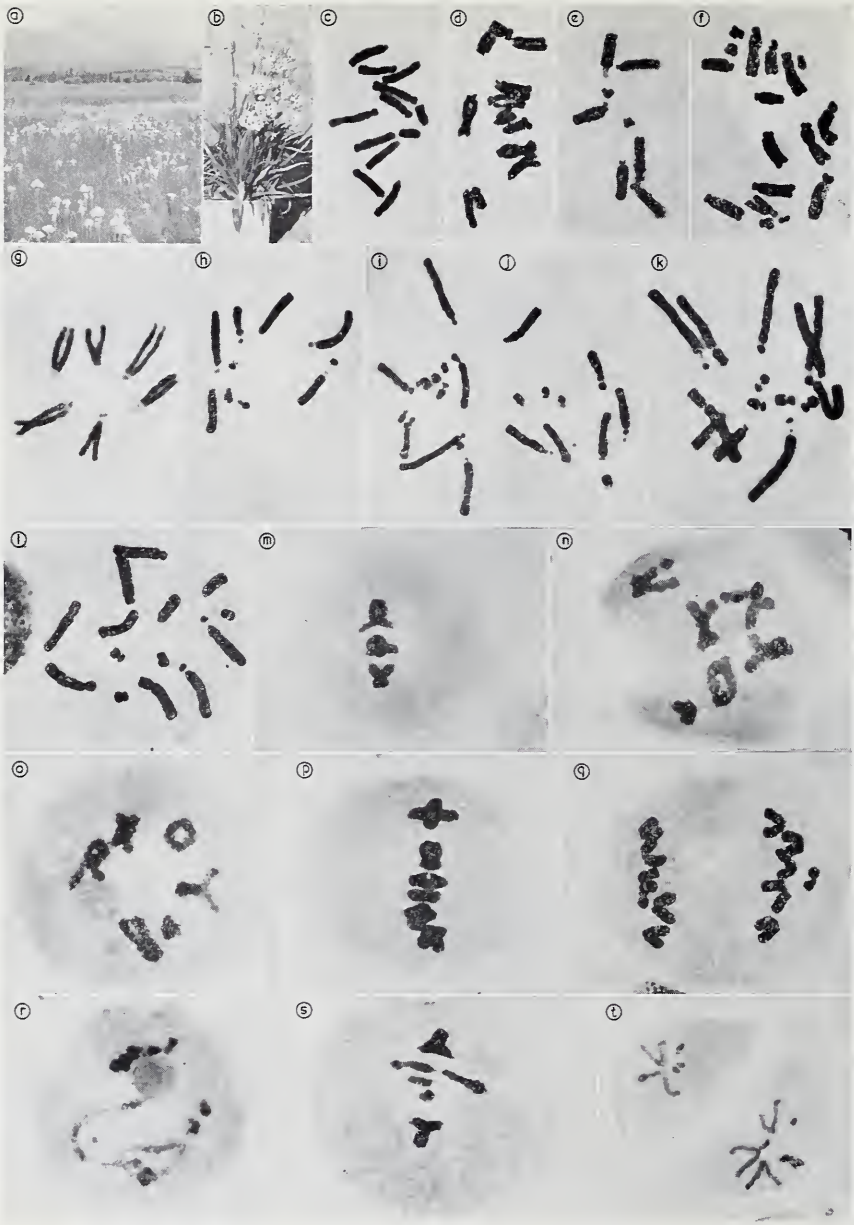
PLAAT XVI.

Idiogramme van die haploïede chromosoomkomplemente van verskillende Ornithogalum spesies (vervolg): (19) *O. lacteum*, Aurora; (20) *O. lacteum*, Pakhuispas; (21) *O. lacteum* forma β, Grahamstad; (22) *O. lacteum* forma, Sutherland; (23) *O. fimbrimarginatum*, Jan du Toitskloof; (24) *O. pruinosum*, Kamieskroon; (25) *O. thyrsoides*, Bokbaai; (26) *O. thyrsoides*, Elsenburg; (27) *O. thyrsoides*, Paleisheuwel; (28) *O. thyrsoides*, Welgevallen, Stellenbosch; (29) *O. thyrsoides*, Swellendam; (30) *O. thyrsoides* forma η, Springbok; (31) *O. thyrsoides* forma, Grahamstad; (32) *O. conicum* var. *strictum*, Clanwilliam; (33) *O. synanthifolium*, Umtata; (34) *O. ranunculoides*, Kamieskroon; (35) *O. maculatum* var. *speciosum*, Kamieskroon; (36) *O. maculatum* var. *splendens*, Roggeveld (x3000).



PLAAT XVII.

Idiogramme van die haploïede chromosoomkomplemente van verskillende Ornithogalum spesies (vervolg): (37) *O. marlothii*, Springbok; (38) *O. hispidum*, Jonkershoek; (39) *O. attenuatum*, Paleisheuwel; (40) *O. graminifolium*, Jonkershoek; (41) *O. leptophyllum*, Witwatersrand; (42) *O. subulatum*, Grahamstad; (43) *O. virens*, Lourenco Marques; (44) *O. setifolium*, Fauresmith; (45) *O. caudatum*, Pietermaritzburg; (46) *O. pretoriense*, Witwatersrand; (57) *O. flavovirens*, Grahamstad; (48) *O. ecklonii*, ex Botaniese Tuin Stellenbosch; (49) *O. prasinum*, Fauresmith; (50) *O. saundersiae*, ex Nas. Bot. Tuin Kirstenbosch; (51) *O. saundersiae*, Nelspruit (x3000).

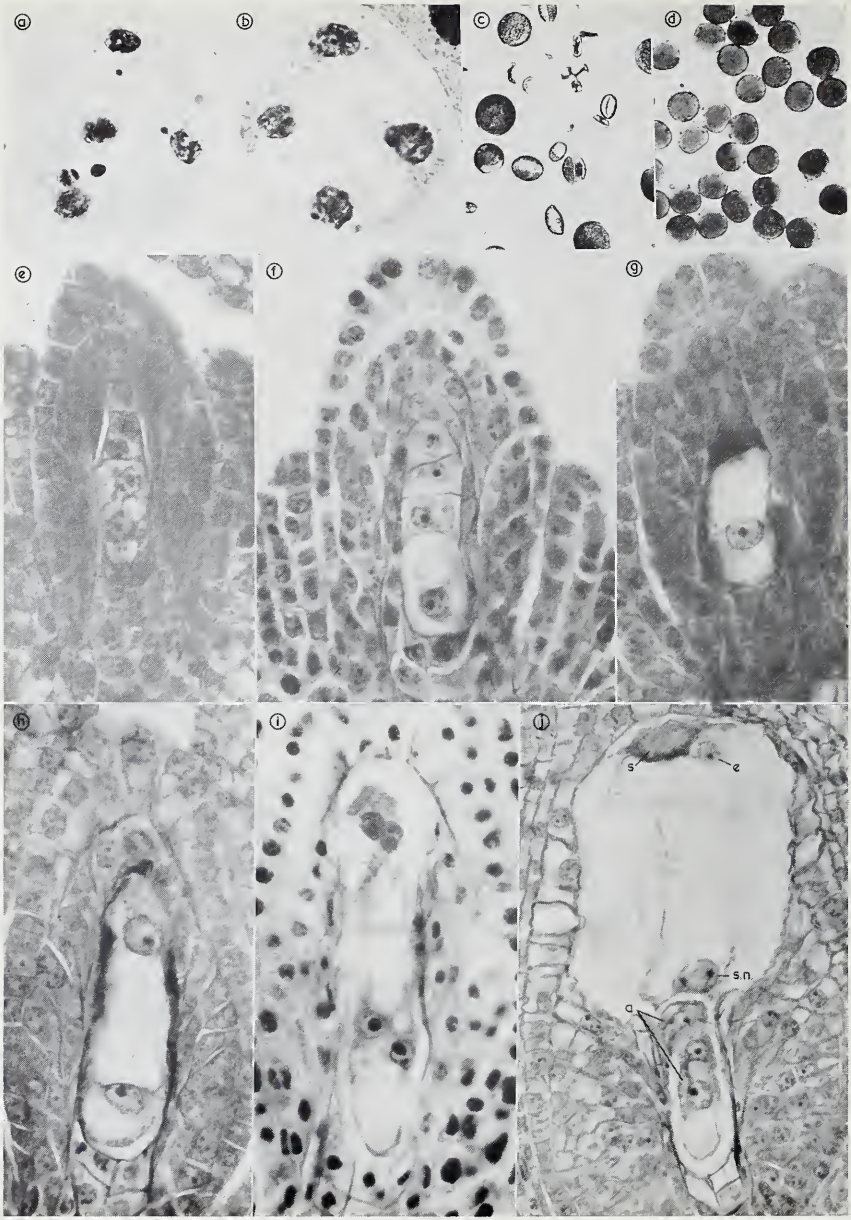


PLAAT XVIII.

(*a*) *O. thyrsoides* populasie op Elsenburg, distr. Stellenbosch; (*b*) *O. thyrsoides*, Kirstenbosch biotipe; (*c–l*) C-metafases in wortelpuntselle van: (*c*) *O. thyrsoides*, Kirstenbosch, x1000; (*d*) *O. leptophyllum*, Witwatersrand, x1000; (*e*) *O. setifolium*, Heuningneskloof, Fauresmith, x1000; (*f*) *O. prasinum*, Heuningneskloof, Fauresmith, x1000; (*g*) *O. virens*, Lourenco Marques, x1400; (*h*) F_1: *O. virens* x *O. pretoriense*, x1400; (*i*) *O. pretoriense*, Witwatersrand, x1400; (*j*) *O. ecklonii*, ex Botaniese Tuin, Stellenbosch, x1400; (*k*) *O. saundersiae*, Nelspruit, Tvl., x1250; (*l*) *O. saundersiae*, ex Nas. Bot. Tuin, Kirstenbosch, x1250; (*m–t*) Meiose in mikrosporosiete van: (*m*) *O. virens*, Lourenco Marques, Metafase I, x1000; (*n*) *O. flavissimum*, ex John Innes Inst., diakinese, x1000; (*o–q*) *O. thyrsoides*, Kirstenbosch: (*o*) diakinese, x1000; (*p*) Metafase I, x1000; (*q*) Anafase I, x1000; (*r–t*) *O. ecklonii*, ex Bot. Tuin, Stellenbosch: (*r*) vroeë diakinese, x1000; (*s*) Metafase I, x1000; (*t*) Metafase II—dui in hierdie geval dat die skeiding tydens Anafase I abnormaal was sodat een van die diade se selle vier en die ander ses chromosome ontvang het, x1000.

PLAAT XIX.

(*a*) *O. virens*, Lourenco Marques, links, en F_1 *O. virens* x *O. pretoriense*, regs; (*b*) *O. pretoriense*, Witwatersrand; (*c*) F_1 *O. pretoriense* ♀ x *O. virens* ♂, links, en F_1 *O. virens* ♀ x *O. pretoriense* ♂, regs; (*d–f*) Meiose in mikrosporosiete van *O. virens*, (*d*) diakinese, x1000, (*e*) metafase I x1000 (*f*) anafase I x1000; (*g–j*) Meiose in mikrosporosiete van *O. pretoriense*, (*g*) vroeë metafase I, (*h*) metafase I wat twee inmekaargeskakelde bivalente vertoon, x1000, (*i*) vroeë anafase I, x1000 (*j*) anafase I, x1000; (*k–q*) Meiose in mikrosporosiete van F_1 *O. virens* x *O. pretoriense*, (*k*) metafase I, vertoon multivalente en monovalente, x875, (*l*) selfde as (*k*) x2000, (*m*) metafase I, al die chromosome het sinapse ondergaan om multivalente te vorm, x2000, (*n*) metafase I, vertoon multivalente en 'n monovalent, x2000, (*o*) anafase I met 'n chromosoombrug, x875, (*p*) anafase I met chromatiedbrug, x875, (*q*) anafase I met betreklik „normale" skeiding, x875.



PLAAT XX.

(*a–c*) F_1 *O. virens* x *O. pretoriense*, vervolg: (*a*) abnormale „tetrade" met talle mikrokerne, x750; (*b*) Oënskynlik normale tetrade, x750; (*c*) Stuifmeel, grotendeels abortief, x75; (*d*) *O. virens* normale stuifmeel x75; (*e–j*) Makrosporogenese en makrogametogenese by *O. thyrsoides*, Elsenburg biotipe: (*e*) Telofase II van makrosporogenese in saadknop; (*f*) Tetrade van vier makrospore met chalazale makrospoor reeds vergroot; (*g*) Chalazale makrospoor het verder vergroot om eenkernige kiemsak te vorm terwyl die orige drie makrospore degenereer het; (*h*) Tweekernige kiemsak; (*i*) Vierkernige kiemsak; (*j*) Volwasse kiemsak; toon een van twee sinergiede, *s*, die eisel, *e*, die sekondêre kern, of versmeltingskern, *s.n.*, kort na vereniging van die polare kerne, en die drie antipodale selle, *a*, in die haustoriumagtige uitgroeisel van die kiemsak.

TABEL 2

Die belangrikste ornithogalum inter- en intraspesies hibriede en die voorkoms van hul met Gliserol-asynkarmyn-gekleurde stuifmeelkorrels.

Vroulike Spesiesouer	Manlike Spesiesouer	Hibried Nr.	Voorkoms van Stuifmeelkorrels
O. pruinosum Loeriesfontein	O. flavissimum Robberg	1102	Feitlik geen normale korrels.
O. thyrsoides Bokbaai	O. lacteum forma Sutherland	1269	Baie normale korrels dog almal 4x.
O. thyrsoides Bokbaai	O. thyrsoides Kruisfontein	1285	Taamlik dowwe korrels.
O. thyrsoides Bokbaai	O. thyrsoides Sandveld	1288	Feitlik 100% normale korrels.
O. thyrsoides Darling	O. hermannii Moorreesburg	671	Feitlik 100% normale korrels.
O. thyrsoides Darling	O. thyrsoides Clanwilliam	685	Feitlik 100% normale korrels.
O. thyrsoides Darling	O. thyrsoides forma η Kamies-kroon	688	Baie min normale korrels.
O. thyrsoides Elsenburg	O. thyrsoides Bokbaai	1190	Meestal normale korrels—net 'n paar dowwe korrels.
O. thyrsoides Heidelberg	O. thyrsoides Durbanville	883	Net 'n paar normale korrels.
O. thyrsoides Heidelberg	O. thyrsoides Elsenburg	885	Net 'n paar normale korrels.
O. thyrsoides Heidelberg	O. thyrsoides Porterville	267	Feitlik geen normale korrels.
O. thyrsoides forma η Kamieskroon	O. alticolum Bredasdorp	904	Manlik onvrugbaar.
O. thyrsoides Kruisfontein	O. thyrsoides Elsenburg	1307	Feitlik 100% normale korrels.
O. thyrsoides Porterville	O. thyrsoides Bokbaai	994	Taamlik dowwe korrels.
		1335	Feitlik 100% normale korrels.
O. thyrsoides Porterville	O. thyrsoides Sandveld	1338	Meestal normale korrels.
O. thyrsoides forma ι Prins Albert	O. alticolum Caledon	999	Minder as 50% normale korrels.
O. thyrsoides Sandveld	O. thyrsoides Elsenburg	1348	Taamlik dowwe korrels.
O. thyrsoides Sandveld	O. thyrsoides Kruisfontein	1352	Bykans 50% normale korrels.
O. thyrsoides forma η Springbok	O. flavissimum Villiersdorp	1046	Manlik onvrugbaar.
		1041	Manlik onvrugbaar.
O. thyrsoides cultivar Port Elizabeth	O. thyrsoides Bokbaai	1319	Baie dowwe en 2x korrels.
		991	Minder as 50% normale korrels.
O. thyrsoides cultivar Port Elizabeth	O. thyrsoides Porterville	988	Bykans 50% normale korrels.
O. thyrsoides cultivar Port Elizabeth	O . thyrsoides Sandveld	1322	Bykans 50% normale korrels.
O. ecklonii Ex John Innes Hort. Inst.	O. ecklonii Ex Bot. Tuin, Stellenbosch	25	Normale stuifmeelkorrels.
O. virens M.V.[1] Lourenco Marques	O. caudatum Pietermaritzburg	201	?
O. virens M.O.[2] Lourenco Marques	O. caudatum Pietermaritzburg	202	?
O. virens Lourenco Marques	O. ecklonii Ex John Innes Hort. Inst.	24	?
Hibried 24 selfbestuif		193	Normale stuifmeelkorrels.
O. virens M.O. Lourenco Marques	O. ecklonii Ex Bot. Tuin, Stellenbosch	203	?
O. virens M.O. Lourenco Marques	O. prasinum Heuningneskloof, Fauresmith	206	?
O. virens Lourenco Marques	O. pretoriense Witwatersrand	3a	Geen vrugbare stuifmeel.
Hibried 3a	O. virens Lourenco Marques	11	?

[1]M.V. = Manlikvrugbaar
[2]M.O. = Manlikonvrugbaar.

gliserol-asynkarmyn gekleur is 'n redelike goeie maatstaf van vrugbaarheid verskaf, aangesien die plante met min oënskynlik normale stuifmeelkorrels baie minder vrugbaar is as diegene wat baie oënskynlik normale stuifmeelkorrels produseer. Uit hierdie bevindings blyk dit dat meeste van Leighton (1944, 1945) se spesies wel op hierdie status geregtig is, aangesien daar 'n mate van onvrugbaarheid by meeste hibriede waar te neem is. Alleen die kruisings:

1. *O. flavissimum* (geel) × *O. miniatum* (oranje);
   O. flavissimum (geel) × *O. fergusoniae* (geel);
   O. miniatum (wit) × *O. thyrsoides forma l.*;
   O. miniatum (oranje) × *O. thyrsoides forma l.*; en

2. *O. thyrsoides* × *O. hermannii*, het hibriede gelewer wat feitlik 100% normale stuifmeel produseer. Die spesies binne (1) en (2) respektiewelik kan dus alleen op ekotipiese status aanspraak maak.

By meeste van die hibriede word nogtans vrugbare stuifmeel gevorm en kan daar dus gene-uitruiling tussen die spesies plaasvind. Inderdaad word hierdie verskynsel in die natuur aangetref:

(1) In die buitewyke van Citrusdal groei *O. thyrsoides* en *O. hermannii* deurmekaar en is talle hibriede van allerlei tussentipes waargeneem.

(2) Hoewel *O. alticolum* en *O. miniatum* (oranje) grotendeels verskillende ekologiese behoeftes openbaar (eersgenoemde kom meer in die vleierige dele van die Caledon-Bredasdorp distrik voor, terwyl laasgenoemde die droër bulte verkies), is dit gevind dat kunsmatige nisse wat deur boerdery en padmaakbedrywighede geskep is, die twee taksa in onmiddellike kruisingsafstand bymekaar bring, wat natuurlike verbastering tussen hulle tot gevolg het. Die natuurlike hibriede lyk soos die eksperimenteel-verwekte hibried nr. 174 uit kruisings tussen die twee genoemde taksa. Alhoewel die F_1 hibriede maar oënskynlik 50% vrugbare stuifmeel-korrels produseer en meeste van die F_2 min lewenskragtigheid vertoon, vind terugkruising in die natuur met genoemde twee taksa plaas sodat allerlei tussentipes in die veld in die nabyheid van hierdie taksa voorkom. Basterswerms soos deur Anderson (1949) beskryf, word dus inderdaad gevorm en dit is duidelik dat introgressiewe verbastering tussen die twee taksa plaasvind. Op hierdie grondslag moet *O. alticolum* en *O. miniatum* en die ander taksa waartussen gene-uitruiling moontlik is, as ekospesies beskou word.

Voorbeelde van taksa wat die status senospesies met betrekking tot mekaar beklee in die sin dat hibriede tussen hulle wel verkry kan word, maar dat gene-uitruiling tussen die taksa weens die onvrugbaarheid van die hibriede nie plaasvind nie, is as volg:

O. thyrsoides forma η en *O. alticolum*;
O. thyrsoides forma η en *O. flavissimum*;
O. lacteum en *O. flavissimum*;
O. lacteum en *O. miniatum* (oranje).

Die hibried *O. conicum* × *O. thyrsoides* is grotendeels onvrugbaar maar 'n paar sade word by terugkruising geset.

In ooreenstemming met die bevindings by ander plantsoorte is dit ook by Ornithogalum waargeneem dat 'n kruising tussen spesies dikwels in een rigting geluk, maar dat die resiproke kruising misluk. Sommige bepaalde ekotipes van 'n spesies kan ook dikwels alleenlik gekruis word met besondere ekotipes van 'n ander soort, bv. tot dusver kon *O. lacteum* forma van Sutherland alleen met die Bokbaai ekotipe van *O. thyrsoides* gekruis word. Verder verskil die F_1

hibriede van die resiproke kruisings somtyds van mekaar ten opsigte van fenotipiese voorkoms en vrugbaarheid, bv.

1. *O. virens* × *O. pretoriense* : F_1 lewenskragtig, blom baie.
   O. pretoriense × *O. virens* : F_1 swak lewenskragtig, blom nie (Plaat XIX).
2. *O. flavissimum* × *O. thyrsoides forma* η : F_1 kort en redelik vrugbaar.
   O. thyrsoides forma η × *O. flavissimum* : F_1 lank, maar onvrugbaar.

Hierdie verskynsel kan toegeskryf word aan die sitoplasmiese effek van die moederspesies op die hibriede-kern, soos ook deur Ölkers by *Streptocarpus* en Michaelis by *Epilobium* aangetoon is (sien Darlington, 1958).

Die wisselwerking van die hibriede-kern met die sitoplasma van die moederspesies, het blykbaar ook 'n nadelige effek op die ontwikkeling van die stuifmeelkorrels, want alhoewel die meiotiese delings van baie spesieshibriede betreklik normaal voorkom, vind 'n groot mate van mikrospoorafsterwing daarna plaas. Hierdie verskynsel bied 'n goeie isolasiemeganisme teen die uitruil van genetiese materiaal tussen spesies. Vollediger besonderhede oor die meiose van die hibriede sal elders verskaf word. Hier kan net nog gemeld word dat tydens meiose in die F_1 hibried uit die *O. virens* × *O. pretoriense* kruising, baie multivalente en chromosoom- en chromatied-brûe gevorm word wat daarop dui dat translokasies en inversies 'n rol gespeel het by die ontstaan van hierdie spesies se kariotipes. (Plaat XIX).

Een van die interessantste kruisings wat nog genoem kan word, is dié tussen *O. thyrsoides* (Bokbaai, 2n = 12) × *O. lacteum forma* (Sutherland, 2n = 10), wat hibried nr. 1269 gelewer het. Alhoewel hierdie sg. *O. lacteum forma* met geen ander *O. lacteum* ekotipe en verskeie *O. thyrsoides* ekotipes kruisverenigbaar is nie, het dit met die Bokbaai ekotipe van *O. thyrsoides* gekruis om genoemde hibried te gee wat 'n somatiese chromosoomaantal van 11 het. (Teksfig. 1). By een van die F_1 plante vorder meiose in die mikrosporosiete net tot die pachinema-diplonema stadium en daarna vind geen verdere chromosoomverdigting plaas om duidelike diakinese bivalente te vorm nie. Inderdaad is die verdere verloop van chromosoomdeling endomitoties of endomeioties en ontwikkel die mikrosporosiete direk tot mikrospore. Die gevolg is dat die tetraploiede stuifmeelkorrels wat uiteindelik gevorm word, van reuse grootte is verhoudelik tot die haploiede stuifmeelkorrels van die spesiesouers. By 'n ander F_1 plant is Metafase I stadia wel waargeneem, maar aangesien talle monovalente gevorm word, is die verdere verloop van meiose so abnormaal dat geen mikrospoortetrade ontstaan nie.

Ruimte ontbreek om 'n lys te gee van al die spesieskruisings wat misluk het, of wat nie-kiemkragtige saad gegee het, of waarvan die hibried saailinge nie lewenskragtig genoeg was om volwassenheid te bereik nie; net 'n paar van die belangrikste hiervan kan genoem word:

Resiproke kruisings tussen *O. lacteum* en *O. thyrsoides*

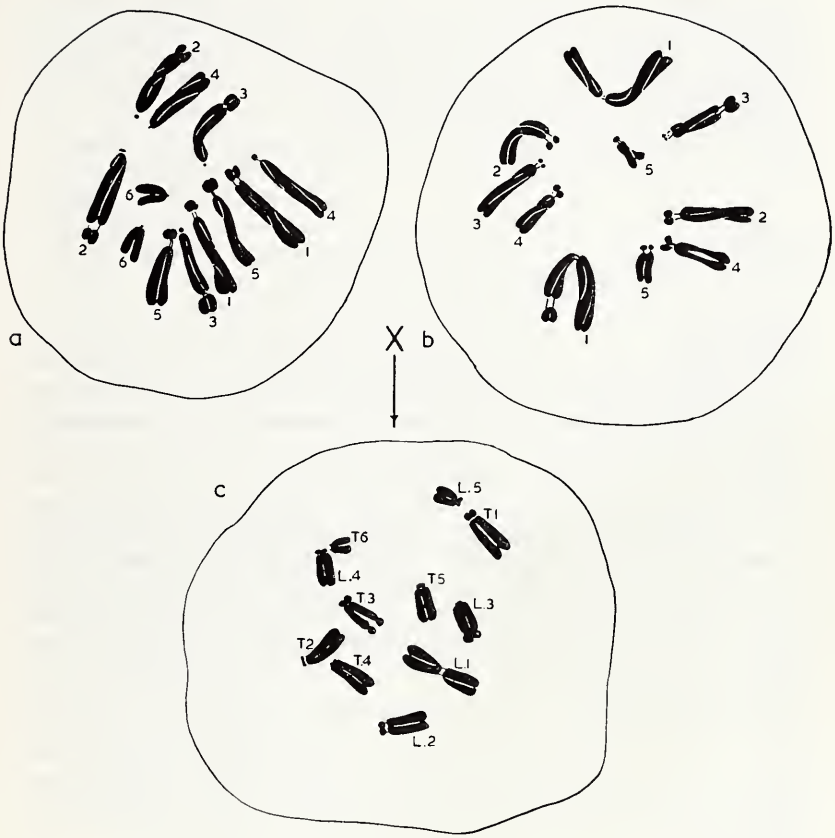
O. alticolum en *O. thyrsoides*
O. synanthifolium en *O. lacteum*
O. lacteum en *O. pruinosum*
O. lacteum en *O. alticolum*
O. lacteum en O. lacteum forma, (Sutherland)
O. miniatum en *O. thyrsoides*
O. maculatum en alle spesies in Tabel I.
O. pruinosum en *O. thyrsoides*
O. ranunculoides en alle spesies in Tabel I.
O. thyrsoides en *O. flavissimum*
O. thyrsoides en *O. synanthifolium*

Kruisings tussen spesies wat verskillende tye van die jaar blom, kan gemaak word deur die stuifmeel van die spesies wat vroeg blom oor kalsiumchloried in die yskas by —1°C. te bewaar tot die ander spesies blom. Hibried nr. 390 (*O. conicum* v. *strictum* × *O. lacteum*) is bv. op die wyse verkry deur die *O. lacteum* stuifmeel vanaf einde November oor te hou tot die volgende Oktober (d.w.s. 11 maande) toe die *O. conicum* v. *strictum* blomme daarmee bestuif is. By die maak van baie kruisings is dit ook voordelig om in navolging van Emsweller (1951, 1952) 'n 1% naftaleenasetamied in lanolien (wolvet) pasta aan die vrugbeginsel se basis te smeer tydens bestuiwing—die vrugbeginsel hou langer goed sodat stadig groeiende stuifmeelbuise kans kan kry om die saadknoppe te bereik.

Manlikonvrugbaarheid is by verskeie spesies waargeneem. 'n Ondersoek van die *O. thyrsoides* populasie op Elsenburg het aangetoon dat 25 plante uit 'n totaal van 2,000 manlikonvrugbaar is. Uit kruisings wat met hierdie plante gemaak is, wil dit voorkom of die genetiese basis vir manlikonvrugbaarheid basies soortgelyk is aan dié van die ui, nl. 'n sitoplasmiese-faktor-resessiewekerngeen-wisselwerking (sien Pienaar, 1958), sodat Smsms genotipes onvrugbaar is, terwyl SMs-, NMs- en Nmsms genotipes vrugbaar is (S is die onvrugbaarheidsfaktor in die sitoplasma). Die oorerwing en openbaring van hierdie eienskap word egter deur modifiseerder gene en/of omgewingsfaktore affekteer.

Uit die selfbestuiwings en kruisingsresultate blyk dit dat uiteenlopende verskille ten opsigte van selfonverenigbaarheid bestaan. Talle spesies soos *O. conicum*, *O. lacteum*, *O. synanthifolium*, *O. flavissimum*, *O. ecklonii*, *O. saundersii*, ens. is besonder selfvrugbaar terwyl meeste van die ander spesies na selfbestuiwing ook geredelik saad produseer. Ekotipes en indiwiduele plante in populasies van *O. thyrsoides* is egter gevind wat heeltemal selfonverenigbaar is, bv. die Kruisfontein en Elsenburg ekotipes respektiewelik.

Outotetraploïdie is kunsmatig by *O. thyrsoides* induseer deur colchicine behandeling van jong saailinge. Die outotetraploiede plante is groter en vlesiger



TEKSFIGUUR 1.
C-metafase plate van (*a*) *O. thyrsoides*, Bokbaai biotipe; (*b*) *O. lacteum* forma, Sutherland biotipe; en (*c*) hibried nr. 1269 = *O. thyrsoides*, Bokbaai x *O. lacteum* forma, Sutherland (x2000).

met groter en mooier blomme as die diploiede kontrole. Uit 'n telersoogpunt het die induksie van poliploïdie beslis waarde. Die saad van die tetraploiede plante ontkiem egter swak. Die tetraploiede is ook met diploiede plante gekruis en het hoofsaaklik onvrugbare triploiede gelewer. Om die kompetisie tussen haploiede en diploiede stuifmeelbuise in diploiede en tetraploiede style vas te stel, is dubbelbestuiwing met diploiede en haploiede stuifmeel op die stempels

van tetraploiede en diploiede plante gedoen. Die volgende resultate is verkry (Tabel III):

TABEL 3

Chromosoomaantalle van F_1 plante na dubbelbestuiwing van diploiede en tetraploiede O. thyrsoides blomme met haploiede en diploiede stuifmeel.

Kruising nr. 1020: 4x♀ × 2x en 4x♂	Somatiese chromosoomaantalle van F_1 plante							
	12	18	20	23	24	25	26	27
Aantal F_1 plante	1	2	1	1	11	5	2	—
Kruising nr. 1022: 2x♀ × 2x en 4x♂								
Aantal F_1 plante	43	—	—	—	3	—	—	—

Oënskynlik funksioneer die diploiede stuifmeel beter as die haploiede stuifmeel by die tetraploiede, want 83% van die nageslag is te wyte aan die bevrugting van die eisel deur 'n diploiede manlike gameet. In teenstelling hiermee funksioneer die haploiede stuifmeel by bevrugting van die diploiede plante se eiselle in 93% gevalle. Die groot verskil in beide gevalle mag egter te wyte wees aan die differensiële afsterwing van die triploiede tydens die ontwikkeling van die embrio of in die saailingstadium. Triploiede word egter geredelik verkry deur kruisings tussen diploiede en tetraploiede te maak en die volwasse triploied is net so lewenskragtig soos die twee ouer tipes. Stuifmeelbuisgroei van diploiede stuifmeel in tetraploiede weefsel is dus blykbaar vinniger as dié van haploiede stuifmeel, terwyl die omgekeerde in die geval van die diploiede stylweefsel geld.

Die aneuploiede plante in die nageslag van die tetraploiede moederplant ontstaan waarskynlik as gevolg van die bevrugting van eiselle met $2x - 1$, $2x + 1$ en $2x + 2$ chromosoomkomplemente deur diploiede manlike gamete. Die volwasse aneuploiede plante verskil in voorkoms van die euploiede. Dit is egter duidelik uit Tabel III dat die tetraploied meer as 60% euploiede $2x$ eiselle vorm.

Die diploiede plant in die nageslag van die tetraploiede moederplant (Tabel III) is of te wyte aan die partenogenetiese ontwikkeling van 'n eisel, of 'n moontlike saadkontaminasie met saadityd. Die drie tetraploiede plante in die F_1 van die dubbelbestuifde diploiede moederplante kon ontstaan het deur die voorkeurbevrugting van diploiede aposporiese of diplosporiese kiemsakke deur die diploiede stuifmeel se gamete. Bevindings uit ander eksperimentele kruisings dui ook op die moontlikheid van sporadiese diploiede kiemsakontwikkeling by *O. thyrsoides*.

'n Sitologiese ondersoek van kiemsakontwikkeling by *O. thyrsoides* (Elsenburg ekotipe) en *O. virens* is gemaak om te probeer vasstel of diploiede kiem-

sakke wel gevorm word. Tot dusver is geen sulke kiemsakke waargeneem nie. Die kiemsakontwikkeling is volgens die patroon van die monosporiese 8-kernige Polygonum-tipe (Maheshwari, 1950) (Plaat XX en XXI), maar in plaas dat die sekondêre of versmeltingskern na vereniging van die twee polare kerne naby die eierapparaat lê, soos gewoonlik die geval is by die Polygonum-tipe kiemsakke, lê dit naby die antipodale selle, soos Battaglia (1959) ook by Scilla aangetoon het. Soos by Scilla lê die antipodale selle ook in 'n haustoriumagtige uitgroeisel van die kiemsak.

'n Volledige kariotipiese, sitogenetiese en sitotaksonomiese uiteensetting van die bogemelde bevindings, asook die gebruik daarvan by die teelt van beter cultivars, sal in hieropvolgende referate breedvoerig bespreek word.

Graag wil ek van die geleentheid gebruik maak om al die persone wat gehelp het met die versameling van die materiaal, hartlik te bedank vir hul gewaardeerde samewerking. Ook 'n besondere woordjie van dank aan mej. W. F. Barker en die ander personeellede van die Compton Herbarium, Kirstenbosch, vir hulle hulp met die identifikasie van die plante, en aan mnr. G. Albertse vir die versorging van die plante.

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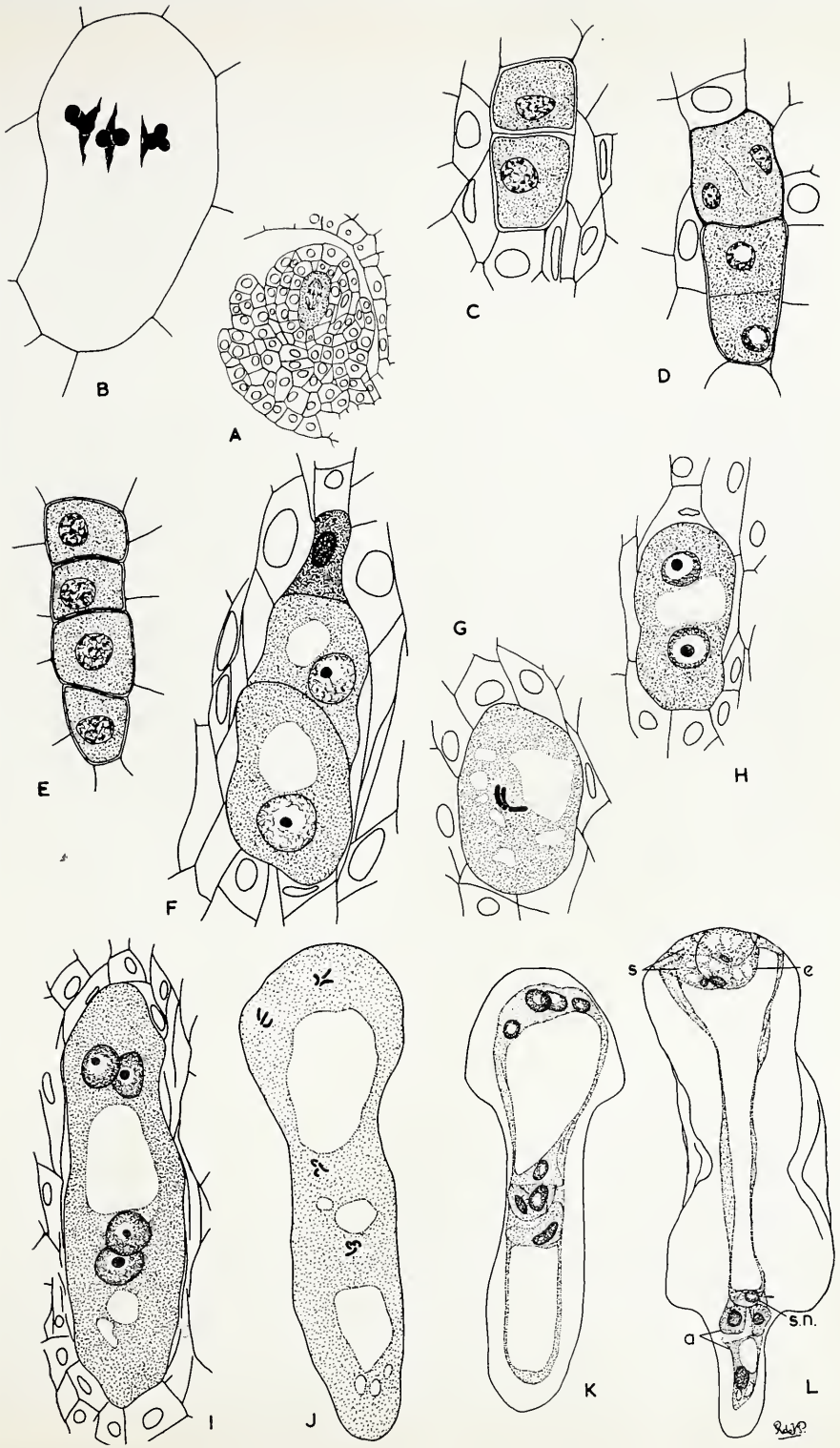
Plaat XXI.

Ornithogalum virens, makrosporogenese en makrogametogenese. (A) Jong saadknop met makrospoormoedersel; (B) Makrospoormoedersel in metafase I stadium wat aldrie bivalente toon; (C) Diade; (D) Telofase II van makrosporogenese; (E) Tetrade van vier makrospore; (F) Chalazale makrospoor vergroot om eenkernige kiemsak te vorm terwyl die ander drie begin degenereer; (G) Eerste mitotiese metafase in eenkernige kiemsak; (H) Tweekernige Kiemsak; (I) Vierkernige kiemsak; (J) Mitotiese metafases in vierkernige kiemsak—al vier kerne deel sinkronies; (K) Agtkernige kiemsak; (L) Volwasse gedifferensieerde kiemsak met eisel, *e*, twee sinergiede, *s*, sekondêre of versmeltingskern, *s.n.*, en die drie antipodale selle, *a*, in die haustoriumagtige uitgroeisel.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NOTES ON MESEMBRYANTHEMUM AND ALLIED GENERA

H. M. L. Bolus

Conophytum vanbredai L. Bol. sp. nov. (*Euconophytum-Wettsteiniana*).—Caespitosum glabrum, senectum sine floribus 2·5 cm. altum; vaginae persistentes per ca. 9 annos, eae anni prioris pergamentaceae, inferne pallide luteo brunneae, senectae demum subpapyraceae atratae; corpuscula obconica vel oblique obconica vel breviter piriformia, supra interdum late ellipticum, planum vel convexum tumque ore depresso, 3 mm. longo, glauce viridia, lateribus interdum purpureo tinctis, ad 1·7 cm. longa, ad 1·5 cm. diam.; flores diurni; pedunculi 5—6 mm. longi, parum supra basim bracteati, bracteis 3 mm. longis, vagina lobis parum breviore, sinu lato; receptaculum in corpusculo profunde inclusum, subglobosum, 2—3 mm. diam.; calyx per 3 mm. inclusus, ad 1·1 cm. longus, tubo membranaceo, anguste viridi 4-nervato, 8 mm. longo, segmentis 4, herbaceis acutis, omnibus marginatis aequilongis; corolla matura non bene visa, ca. 1·9 cm. longa, immatura ad 1·6 cm. longa, tubo superne ampliato, albo, 9 mm. longo, segmentis 3—4-seriatis, ad 7 mm. longis, inferne angustatis albisque, superne purpureo roseis, obtusis, ad 1 mm. latis; filamenta ad 8 mm. longa, ca. 6-seriata, e basi tubi adnata, pauca etiam in receptaculo manentia, inferne pallida, superne lutea, vel superiora breviora omnino aurea, antheris pollineque luteis; discus inconspicuus; ovarium circa marginem planum, in medio ad 0·75 mm. conice elevatum; stylus 5 mm. longus; stigmata aurea, ad 7 mm. longa; capsulae anni prioris pallidae 4—5 mm., expansae 8 mm., diam., infra breviter conicae, subspongiosae, supra visae obscure 4-angulatae, medio leviter elevato, seminibus pallide brunneis; lobi bractearum brunneo punctati, ad 2 mm. diam. accreti.

Cape Province: Namaqualand; prope Garies, "on the farm Loerkop," *P. H. B. van Breda*, 603/61. Fl. Apr. 1963.

Conophytum francisci L. Bol. sp. nov. (*Euconophytum—Picta*).—Planta integra 1 visa, caespitosa glabra, sine floribus 1·7 cm. alta, ad 2·5 cm. diam., caule ca. 4 mm. diam., radicibus fibrosis; vaginae persistentes tenuiter pergamentaceae, albidae, in unica ad 5 corpuscula notata, 3 florentia, 2 extrema novella; corpuscula piriformia vel ultra pedunculum producta itaque anguste piriformia, glauce viridia, inferne purpurea, apice convexa, punctis saturate viridibus vel sordide purpureis, sparsis vel rarius 3—5 approximatis, lineis in latera productis, ornata, ore punctis cincto, interdum anguste membranaceo

marginato, glabro vel in novellis sterilibus leviter elevato, labiis subringentibus interdumque dense ciliatis, ciliis oppositis contiguis, 6—10 mm. longa, ad 4 mm. lata, ad 6 mm. diam.; flores 17 visi, nocturni; pedunculus 3—5 mm. longus, basi vel prope basim bracteatus, bracteis pallide viridibus, ad 1·75 mm. longis, lobis obtusis, vagina paulo longioribus, sinu rotunde excavato; receptaculum subglobosum, 1—1·75 mm. longum diametroque; calyx 4—5 mm. longus, tubo 2·5—3·5 mm. longo, inferne submembranaceo, superne, cum segmentis 4—5 subobtusis subaequilongis, rubre brunneo; corolla 9—12 mm. longa, tubo albo, 4—5 mm. longo, segmentis ca. 18, laxissimis 3—4-seriatis, obtusis vel intimis acutis, inferne albis, superne pallide roseis, 0·25—0·75 mm. latis; stamina ca. 3—4-seriata, e parum infra medium adnata, suprema parum exserta, filamentis albis, antheris pollineque, pallide citrinis vel stramineis; discus sat conspicuus, e segmentis truncatis crenulatis compositus; ovarium circa marginem concavum, medio subconice ad altitudinem disci elevatum; stylus cum stigmatibus 4—5 ad 1·75 mm. longus, stigmatibus quam stylo fere duplo longioribus.

Cape Province: in dit. Calvinia; "Brakfontein Farm, near Loeriesfontein," Maio 1961, *Frank J. Stayner*. Karoo Garden 188/61. Fl. Jun. 1961 et Maio 1963.

Conophytum sulcatum L. Bol. sp. nov. (*Derenbergia*).—Plantae 3 visae, caespitosae graciles glabrae, e 4—9 corpusculis compositae, sine floribus ad 2 cm. altae; radix fibrosa; partes herbaceae saturate virides; vaginae persistentes anni prioris tenuiter pergamentaceae, inferne longitudinaliter sulcatae, pallide brunneae, superne rugosae sulcataeque albidae, ad 1·4 cm. longae; corpuscula lat. visa cuneata vel anguste cuneata, ad 1·6 cm. longa, apud apicem ad. 8 mm. diam. cum divergio 2 mm., apud apicem vaginae ad 6 mm. lata, lobis supra visis acutis, lucide marginatis itaque pagina superiore bene definita, inconspicue lineatis, ad 2·5 mm. longis, basi 2 mm. latis, lat. visis truncatis, lucide carinatis, carina ad per 2 mm. producta, dorsale lateraliterque ultra paginam superiorem ampliatis ibique lineis prominentibus sublucidis, ad 4 mm. longis, ornatis, inter lineas sulcatis, sulcis utrimque ad 7, orificio 2 mm. longo; pedunculus ad 4 mm. longus, parum supra basim bracteatus, bracteis basim ovarii attingentibus, herbaceis, vagina lobos obtusos aequante, sinu angusto rotundato; calyx ca. 6 mm. longus, tubo membranaceus, segmentis 5, herbaceis marginatis, ad 1·5 mm. longis; corolla ad 2·3 cm. longa, tubo superne ampliato, ad 1·3 cm. longo, segmentis 2—3-seriatis, subaequilongis, obtusis, inferne albis, superne roseis, 1—1·75 mm. latis; stamina 3—4-seriata, sat pauca, e medio tubi adnata, suprema breviter exserta, antheris pollineque luteis; ovarium in stylum ca. 2—4 mm. longum insensim transeuns; stigmata 5, gracillima aurantiaca, ad 9 mm. longa.

Cape Province: Namaqualand; "24 miles S. of Vioolsdrift," Maio 1961, *R. C. Littlewood*. Karoo Garden 333/61. N.B.G. 281/62. Fl. Apr. 1963.

The upper surface of the lobes in this very distinct species is well defined by its lucid margins and keel, and the orifice coincides with the base of the lobes as is usual in the subgenus *Derenbergia*.

Conophytum geyeri L. Bol. sp. nov. (*Euconophytum-Wettsteiniana*).—Caespitosum glabrum; vaginae persistentes anni prioris pergamentaceae, inferne brunneae, superne pallidiores, saturate brunneo punctatae; corpuscula obconica vel latissime obconica, supra plana vel rarius convexa tumque ore, 2·5—3 mm., vel manu complanato ad 4 mm., longo, deprcsso, levia, glauce viridia, 9—10 mm. longa, ad 16 mm. lata diametroque; flores 4 visi, diurni; pedunculi 5—6 mm. longi, proxime basim bracteati, bracteis herbaceis, 2 mm. longis, lobis latissimis, vaginam aequantibus, sinu angustissimo; receptaculum inclusum, 1·5 mm. longum, ad 2 mm. diam.; calyx exsertus, 6—7 mm. longus, tubo tenuiter herbaceo, pallide viridi, late viridi 4-nervato, 4—5 mm. longo, segmentis 4, carnosis convexis obtusis, exterioribus interioribus fere duplo latioribus, ad 2 mm., interioribus 1·5 mm., longis; corolla ad 1·7 cm. longa, tubo albo, ad 7 mm. longo, segmentis ca. 3-seriatis, prope apicem angustatis, acutis vel obtusis, purpureo roseis, 5—10 mm. longis, 0·5—1·25 mm. latis; filamenta ca. 6-seriata, e parum supra basim tubi adnata, inferne pallida, superne aurea vel aurantiaca, ad 7 mm. longa, superiora bene exserta, antheris pollineque aureis; discus sat inconspicuus; ovarium concavum, medio tantum fere cylindrice ad 0·75 mm. elevato, in stylum pallidiorem, 6—8 mm. longum, insensim transeuns; stigmata 4 in floribus 2, 6 in floribus 2, visa, 2—3 mm. longa.

Cape Province: Namaqualand; Sendlingsdrift, *A. L. Geyer*. N.B.G. 593/60. Typus. Fl. Apr. 1963. Ibidem, "on top of quartz-strewn mound," Nov. 1962, *R. C. Littlewood*. Karoo Garden 1120/62. Fl. Maio 1963.

Conophytum subcylindricum L. Bol. sp. nov. (*Derenbergia*).—Planta 1 visa, dense caespitosa, 5 cm. alta, 12 cm. diam.; rami primarii reliquiis dense imbricatis vaginarum, ad per 7 annos vel ultra persistentibus, vestiti; vaginae anni prioris asperae, ad 2·1 cm. longae, tubo pergamentaceo vel subcoriaceo, lobis incrassatis induratisque; corpuscula lat. visa fere cylindrica vel vagina superne leviter ampliata convexaque, aspera vel minute asperula, pallide glauce viridia, apice loborum interdum inconspicue rubre notato, parte pellucida subquadrata, vel subcordiformia vel oblonga, lobis 3—7 mm. longis, subtruncatis vel rotunde truncatis vel subrotundis, supra visis obtusis, 1·5—3 cm. longa, medio vaginae ad 7 mm., apice ad 4 mm., lata, apice vaginae, manu complanata, 7—12 mm. diam.,prope apicem, cum divergio 2—7 mm., 8—13 mm. diam.; pedunculi 7—12 mm. longi, parum supra basim vel parum infra medium bracteati, bracteis fere omnino membranaceis, obtusis, ca. 2 mm. longis, vagina lobos aequante,

sinu lato; receptaculum 1 mm. longum. ad 2 mm. diam.; calyx partim inclusus, ad 8 mm. longus, tubo membranaceo, obscure viridi 5-nervato, ad 6 mm. longo, segmentis 5, herbaceis obtusis, sat anguste marginatis, subaequilongis; corolla 1·5—2 cm. longa, tubo superne leviter ampliato, pallido, 7—10 mm. longo, segmentis ca. 4-seriatis, exterioribus acutis vel obtusis, interioribus acutis, laete luteis, senectis demum atratis, ad 1 mm. latis; stamina ca. 6-seriata, fere omnia demum exserta, superne vel omnino aurantiaca, antheris pollineque luteis; ovarium fere ad 1 mm. conice elevatum, in stylum 4 mm. longum insensim transeuns; stigmata 5, ad 6 mm. longa; capsulae plures visae, infra obconicae vel globose obconicae, 2 mm. longae, supra obtusissime 5-angulatae, medium versus elevatae, suturis vix compressis, saturate brunneae, crebre brunneo punctatae, madidae 4—5 mm., expansae 1—1·2 mm., diam.

Cape Province: Namaqualand; "near the farm Gemsbokvlei, about 15 miles from Port Nolloth on the road to Steinkopf," Nov. 1962, *Hardy and Bayliss* 1196. Fl. Mart. 1963. N.B.G. 1044/62. Worcester Veld Reserve, *P. H. B. van Breda* 1854/62.

Conophytum gonapense L. Bol. sp. nov. (*Derenbergia*).—Planta 1 visa, caespitosa glabra, cum flore ad 5·5 cm. alta; caulis basi 7 mm. diam.; vaginae persistentes annorum ca. 9 dense imbricatae, coriaceae vel induratissimae, supremae etiam atratae; corpuscula lat. visa cordiformia vel late cordiformia, levissima viridia, inconspicue parceque saturate viridi maculata, 2·5—3 cm. longa, in medio vaginae ad 1·1 cm. lata, apud apicem vaginae, manu complanata, 1·5—3·5 cm. diam., divergio 8—11 mm., vagina ad 2 cm. longa, lobis supra visis acutis, basi 6—8 mm. latis, lat. visis truncatis vel rotunde truncatis, marginibus apiceque anguste purpureo lineatis, in medio 7—14 mm. diam., pustula sat inconspicua, parte pellucida in altero latere anguste cuneata, in altero late cuneata, ad 6 mm. longa, vel lineare adque 11 mm. longa; pedunculi ad 1·4 cm. longi, 4 mm. a basi bracteati; receptaculum 1·5—2·5 mm. longum, 3 mm. diam.; calyx partim inclusus, 8—9 mm. longus, tubo submembranaceo, anguste viridi 5—6-nervato, ad 6 mm. longo, segmentis 5—6, obtusis, rubre brunneis, 2·5—3 mm. longis, basi ad 2 mm. latis; corolla 1·8—2·3 cm. longa, tubo pallido, superne leviter ampliato, 7—11 mm. longo, segmentis 3—4-seriatis, obtusis luteis, 0·5—1·25 mm. latis; filamenta ca. 6-seriata, e basi tubi adnata, inferiora alba, ad 9 mm. longa, superiora breviora lutea exserta; discus inconspicuus crenulatus; ovarium conice ad 1 mm. elevatum; stylus 1—3 mm. longus (stigmatibus 11—12 mm.); stigmata 5—6, 11—8 mm. longa; capsula sublignosa, saturate brunnea, atre punctata, 6 mm., expansa 12 mm., diam., infra obconica, 2 mm. longa, supra plana, in medio tantum per 1·25 mm. elevata, suturis leviter compressis.

Cape Province: Namaqualand; Gonap Beacon, Sept. 1962. *P. van Heerde.* Bolus Herb. 27373. Flor. hort. van Heerde Apr. 1963.

Conophytum boreale L. Bol. sp. nov. (*Fenestrata-Pellucida*).—Corpuscula 3 visa, oblonga, basi rotundato, vel subovalia, glabra, biloba, lobis ad 2 mm. longis, fenestris non bene visis, in siccis atre brunneo punctatis breviterque lineatis, 7—10 mm. longa, ad 6 mm. lata, apice ad 9 mm. diam. cum divergio 2 mm., ore latitudinem corpusculi aequante; pedunculi 4—6 mm. longi; bracteae basales obtusae, vagina lobis parum breviore, 2 mm. longae; receptaculum inclusum, 1 mm. longum, ad 1·25 mm. diam.; calyx partim inclusus, ad 4 mm. longus, segmentis 4, latissime marginatis, ad 2 mm. longis; corolla probabile alba, 1·4 cm. longa, tubo 6—7 mm. longo, segmentis 3-seriatis, obtusis, ad 1·25 mm. latis; staminodia 1-seriata, obtusa, subaequilonga, 1·5 mm. longa; stamina 2—3-seriata, bene inclusa; stylus brevissimus cum stigmatibus 4 vix ad 2 mm. longus.

Cape Province: Bushmanland; inter Kakamas et Augrabies Falls, "in moss on rocks," Apr. 1936, *C. L. Leipoldt* 4414. E dissectionibus siccis e vivis feris factis descriptum.

Conophytum astylum L. Bol. sp. nov. (*Fenestrata-Pellucida*).—Corpuscula oblonga vel obovata, apice late elliptico vel fere circulari, convexo, brunnea vel sordide viridia, fenestra insulis rubris ornata, 8—10 mm. longa, 4—5 mm. lata, 7—8 mm. diam., ore ca. dimidium latitudinis corpusculi metiente; receptaculum inclusum; calyx partim inclusus, 4—5 mm. longus, segmentis 4, obtusis roseis aequilongis, 1·5 mm. longis; corolla 1·8 cm. longa, tubo albo, ad 1 cm. longo, segmentis obtusis vel subtruncatis, roseis, ad 1·25 mm. latis; staminodia obtusa, rosea vel lutea, 1·5—2 mm. longa; stamina 4-seriata; ovarium conice fere ad 1 mm. elevatum; stylus nullus (itaque nomen); stigmata 4, ca. 1 mm. longa. L. Bol., Mesemb. 3: pl. 42, B. Ex icone descriptum.

Cape Province: in dit. Vanrhynsdorp; prope Vanrhynsdorp, *P. R. Frames.* Bolus Herb. 24116. Fl. hort. Frames Feb. 1936.

Ophthalmophyllum noctiflorum L. Bol. sp. nov.—Plantae 6 visae, glabrae, e corpusculo singulo compositae; corpuscula globosa vel subglobosa, interdum lateraliter subcompressa tumque 1·4 cm. longa, prope apicem 2 cm. diam., rarius superne e prope medium leviter angustata, dimidio inferiore nitente minuteque papillato, omnino viridia, fenestra subpellucida, interdum viridi punctata, fenestrulis nullis vel obscuris, 1·2—1·6 cm. longa, 1·3—2 cm. diam., ore depresso, florente ad 5 mm. longo; flores 4 visi, nocturni suaveolentes; pedunculi 6—10 mm. longi, proxime basim bracteati, bracteis herbaceis obtusis, 3 mm. longis, vagina lobos aequante, sinu lato; receptaculum 2—3 mm. longum, 4—5 mm. diam., tubo brevissimo; calyx exsertus herbaceus, tubo ad 5 mm. longo, corollae per 1 mm. adnato, segmentis 6, superne angustatis, acutis vel subobtusis, omnibus marginatis, 3—3·5 mm., vel ad 4 mm., longa, basi ad 2 mm. lata; corolla 1·3—1·6 cm. longa, tubo albo, 6 mm. longo, segmentis

4—5-seriatis, exterioribus sat pallide roseis, obtusis, interioribus acutis vel acuminatis, albis vel pallidissime roseis; filamenta ca. 4—5-seriata, alba, e parum infra medium tubi adnata, ad 7 mm. longa, antheris pollineque albidis; staminodia nulla; discus e segmentis truncatis emarginatis compositus; ovarium concavum, medio ad ca. 0·75 mm. elevatum; stylus non bene ab ovario distinctus, subnullus vel 1 mm. longus; stigmata 6, gracilia, breviter caudata, matura conspicue papillata, in flore unico senecto aurea, ad 6 mm. longa; capsula seminaque non visa.

Cape Province: Namaqualand; "14 miles N.E. of Stinkfontein," Nov. 1962, *R. C. Littlewood.* Karoo Garden 1352/62. Fl. Apr. 1963.

Mr. Littlewood writes: "The flowers expand from about 8—9 p.m. and have one of the most powerfully fragrant scents I have known in the *Mesembrieae.* The collection was made on the north-eastern slopes of undulating mounds, in very hard stony ground, which makes their extraction difficult. Individuals were widely dispersed over a large area."

Cephalophyllum baylissii L. Bol. sp. nov. (*Documbentia*).—Planta 1 visa, laxe caespitosa, 11 cm. diam.; rami decumbentes teretes, sine floribus ad 4 cm. longi, internodiis 2—10 mm. longis; "cephala" vix visa; folia ascendentia vel patentia, supra visa linearia, e parum supra medium superne angustata, acuta, lat. visa prope apicem leviter angustata, acuta, lateribus planis vel convexulis, carinata, in junioribus carina acuta, viridia, ad 3 cm. longa, ad 4 mm. lata diametroque; pedunculi intrusi, ad 3·5 cm. longi, ad 1·5 mm. diam.; receptaculum ca. 1·5 mm. longum, 8 mm. diam., vel in flore senectissimo basi fere complanatum; sepala 5, inferne complanata, superne acute subulata, exteriora obtuse carinata, interiora late brunneo marginata, 5—7 mm., vel in flore altero 4—7 mm., longa, basi 3—4 mm. lata; petala dense 3-seriata, inferne non vel vix angustata, obtusa rosea, dorso saturatiore rosea vittataque, 5—11 mm. longa, ad 1 mm. lata, angustissima in genere visa; stamina 4-seriata, omnino alba, ad 4 mm. longa; ovarium convexum, lobis in junioribus superne leviter compressis, demum ad 2 mm. elevatum; stigmata 12—14, angustissime subulata, longe attenuata, purpurea, demum ad 3 mm. longa.

Cape Province: in dit. Riversdale; prope Riversdale, *R. D. Bayliss.* N.B.G. 828/62. Fl. Maio 1963.

Argyroderma hallii L. Bol. sp. nov.—Plantae 3 visae, e ramulis hornotinis 2-foliatis ad 10 compositae, cum reliquiis floribusque ad 4 cm. longis; partes herbaceae glauce virides; folia per anthesin ad per 2 cm. divergentia, subaequilonga, supra visa ovalia vel anguste ovalia, obtusa vel acuta, pustula subnulla, lateribus convexis, dorso rotundata, lat. visa apud apicem subrotundata, carina ad lineam reducta, ultra apicem paginae superioris leviter producta, 2·5—3 cm.

longa, apud apicem vaginae latissima ibique 1·2—1·5 cm. lata et 7—12 mm diam.; pedunculus teres, 5—10 mm. longus, basi bracteatus, bracteis divergentibus compressis, acute carinatis, lat. visis truncatis, basim receptaculi vel parum ultra attingentibus, ad 1·4 cm. longis cum vagina 6 mm. longa; receptaculum apud apicem leviter constrictum, 7 mm. longum cum tubo 3—4 mm. longo, parte inferiore subglobosa, 3—5 mm. diam.; sepala 6—7, apud apicem compressa, omnia marginata, 3—4 mm. longa, basi 2·5—4 mm. lata; petala exteriora ca. 3-seriata densa, e prope medium leviter vel vix angustata, obtusa vel saepius truncata emarginataque, laete rubre purpurea, 7—14 mm. longa, saepius ad 1 mm. lata, interiora sat pauca ca. 4-seriata, 2—6 mm. longa; stamina ovarium attingentia, filamentis epapillatis albis, ad 5 mm. longis, antheris pollineque pallide luteis; pulvinus 1·5 mm. diam.

Cape Province: in dit. Vanrhynsdorp; Hol River, prope Koekenaap, Oct. 1962, *H. Hall* 2498. N.B.G. 675/62. Fl. Maio 1963.

Astridia swartpoortensis L. Bol. sp. nov.—Planta 1 visa, 30 cm. alta; partes herbaceae velutinae; folia ascendentia, demum patentia, supra visa lanceolata vel lineare lanceolata, e medio superne angustata, acuminata vel acuta vel subobtusa, lat. visa e prope medium superne angustata acuta, glauce viridia, suprema 3·5—4 cm., cetera ad 6 cm., longa cum vagina 2 mm., medio ad 1 cm. lata et 1·8 cm. diam.; pedunculus brevissimus; bracteae lat. visae oblique ovatae, acuminatae, prope apicem leviter excavatae, 1·5 cm. longae; receptaculum brevissimum in genere notatum, vix 2 mm. longum, ad 9 mm. diam.; sepala extima e medio angustata, obtusa, ad 1·1 cm. longa, basi 6 mm. lata, interiora 8—10 mm. longa, superne subulata, subula valde compressa acuta; petala exteriora 2—3-seriata, e prope medium inferne angustata, obtusa rubra, 2—2.2 cm. longa. 2—2.5 mm., vel rarissime ad 3 mm., lata, interiora pauca, ad stamina appressa, acuminata, ad 1·1 cm. longa, ad 0·75 mm. lata; staminodia nulla; filamenta ca. 7-seriata, infra medium alba. superne rubra, antheris pollineque aureis; ovarii lobi erecti, ad 1·5 mm. elevati; stigmata gracilia, longe attenuata, inconspicue papillata, 8 mm. longa cum cauda fere 2 mm.

Cape Province: Namaqualand; Swartpoort, "up stream from Sendlingsdrift, the most easterly record S. of the Orange River," *H. Hall*. N.B.G. 107/58. Fl. Apr. 1963.

CORRECTION AND ADDITIONAL NOTES

Sphalmanthus lignescens L. Bol. nom. nov. vice *Mesembryanthemum suaveolens* L. Bol., Mesemb. 3: 297 (1958). The specific name is invalid being a later homonym of *M. suaveolens* Schwant., used in 1926, now **Stomatium suaveolens** (Schwant.) Schwant. The generic name is incorrect. The type specimens are

detached herbaceous flowering branchlets and it was only when it was collected again in the type-locality in 1961 by R. C. Littlewood and grown in the Karoo Garden that it was recognized as a **Sphalmanthus.** Mr. Littlewood gives the following dimensions in 1963: height 53 cm., diameter 70 cm.; diameter of stem at base about 2 cm. and of the old branches, 15 mm.

Mr. J. Rourke who has examined the stem writes: "A section through the stem reveals that secondary thickening takes place by means of almost complete rings of xylem and phloem. This is one of the characteristic types of secondary growth in the Aizoaceae and is described by Metcalf and Chalk (1950). After an examination of all the stages of growth by means of sections, I came to the conclusion that the plant was between 10 and 15 years old."

The type-locality of **Conophytum morganii** Lavis is unknown. Last year it was collected near Willowmore by Mr. J. A. Marais (N.B.G. 436/62) and flowered freely at Kirstenbosch during this year. The plant was about 8 cm. in diameter and the bodies up to 3·2 cm. long; corolla-segments lax, the outer ones acute or acuminate and the style absent.

In August 1962 a second and fine collection (*Bayliss* 622) of **Drosanthemum anomalum** L. Bol. was made on the farm Bokdam, near Stormsvlei in the Robertson Division, by Col. Bayliss. The whole plant is up to 25 cm. in diameter, the upper part of the rootstock 4·2 cm., and the branches up to 1·2 cm., in diameter. The type was found near Montagu in Oct. 1936 by Mr. J. Hurling.

Note.—The type specimens of all new species described in this paper are in the Bolus Herbarium, University of Cape Town, Rondebosch.

(*To be continued*)

A NEW SPECIES OF CONOPHYTUM AND NOTES ON THE SUBGENUS FENESTRATA AND THE SERIES MINUSCULA AND MINUTA OF EUCONOPHYTUM

R. C. Littlewood

Conophytum areolatum Littlew. sp. nov. (*Fenestrata-Pellucida*).—Planta saepius e 5 corpusculis composita, glabra; corpuscula minima in subgenere notata, lat. visa cordiformia, apice ovalia, leviter 2-loba, lobis ± aequalibus, omnino insulis punctisque ornatis, dilute brunneis, insulis viridibus, punctis impressis, rubre roseis, orificio depresso ciliato, ca. dimidium latitudinis corpusculi metiente, lateribus viridi brunneis, 6—8 mm., vel rarius ad 10 mm., longa, 6—7 mm. diametro; calyx membranaceus, 7 mm. longus, segmentis 5, subaequalibus, ca. 1·5 mm. longis; corolla alba, ad 1·9 cm. longa, tubo 1·1 cm. longo, segmentis 2—3-seriatis, apice rotundatis vel truncatis leviterque emarginatis, 5—8 mm. longis, ad 1·5 mm. latis; staminodia apice rotundata vel subtruncata, aurea, ad 3 mm. longa; stamina 4-seriata, suprema apicem tubi attingentia; stylus nullus; stigmata 5, 1·5 mm. longa.

Cape Province: Namaqualand; 18 miles N. of Khamieskroon, in shallow granite rock-pans with an eastern aspect, Oct. 1959, *R. C. Littlewood.* Karoo Garden 707/59. Fl Mart. 1960.

The name is derived from the Latin *areola* (diminutive of *area*), little space, in allusion to the honeycomb-appearance of the window.

In the classification of the genus **Conophytum** by Dr. A. Tischer as given in Jacobsen, Handb. 3 : 1042 (1960), there are 4 main divisions, each of which represents a subgenus. This may be subdivided into series, and the latter further divided into subseries. To serve as a guide a type-species is quoted in all the divisions made. But as the classification has been largely based on vegetative characters and the floral structure not been fully taken into consideration, species with widely differing floral characters from those of the type-species have been included. In order to make the classification more satisfactory these should be excluded. The first subgenus is FENESTRATA N. E. Br. ("windowed plants") with **C. fenestratum** Schwant. as the type-species. The subgenus is then divided into 2 series—*Pellucida* Schwant., with **C. pellucidum** Schwant. as the type-species, and *Subfenestrata* Tisch., with **C. subfenestratum** Schwant. as the type-species. These species were described without flowers, but from the 4-locular capsule recorded for both we may infer there were 4 calyx-segments

and stigmas. **C. pellucidum**, in the first instance also described without flowers, was figured in Labarre, Mesemb. : 178, fig. 71 (1931) and the following brief description of the flower given: "Corolla 12—25 mm. in diameter, with a tube 8—10 mm. long, white with a ring of yellow staminodes at the mouth of the tube." Now it is the best known and the most widely distributed species of the genus, and may serve as a substitute for the insufficiently known species mentioned above. In Miss Carter's drawing (L. Bol., Mesemb. : 3, pl. 42, C.8) a longitudinal section of part of the flower is given, showing the "staminodes" at the apex of the corolla-tube, all the stamens enclosed in the corolla-tube, and the stigmas longer than the style, but not reaching the anthers of the lowest series of stamens. These characters, taken together with the fenestration, readily distinguish this subgenus from all the other subgenera in Dr. Tischer's classification.

Apart from **C. cylindratum** Schwant., described without flowers and with no recording of fenestration, there are 6 species, in all of which the staminodes are absent, all or some of the stamens exserted, the stigmas also exserted (remarkably so in **C. concavum**), except in the variable **C. pillansii** where they are *sometimes* enclosed. No fenestration is recorded for **C. halli, C. rubroniveum, C. primosii** (where the lobes are described as being *not* pellucid) and **C. roodiae**. The last 2 species might well be transferred to the subgenus DERENBERGIA.

The geographical distribution of the FENESTRATA, thus emended, is confined to the Vanrhynsdorp Division, Namaqualand and Bushmanland, "near Vanrhynsdorp" being the most southerly station recorded. The Namaqualand species range from 15 miles N. of Bitterfontein to 10 miles N. of Concordia, Garies, Khamieskroon, Mesklip and Springbok being intermediate stations. In Bushmanland, their eastern range, they are recorded from Kliprand, Gamoep, Namies and Pofadder, with one collection made between Kakamas and the Augrabies Falls. They are found in shallow gravel-filled rock-pans or in rock-crevices of granite-composed koppies, or in partially decomposing rock-outcrops. As with the majority of pan-dwelling **Conophyta** the roots are fibrous.

KEY TO THE SPECIES OF THE SERIES FENESTRATA

1. Capsule 4-locular; calyx-segments and stigmas 4.
   2. Corolla-segments white; style present, sometimes very short.
      3. Body narrowly clavate; orifice ciliolate .. TERRESTRE
      3. Body not narrowly clavate; orifice glabrous.
         4. Orifice equalling the width of the body.
            5. Body slightly bilobed; corolla-segments up to 2·75 mm. broad .. PARDICOLOR
            5. Body-lobes up to 2 mm. long; corolla-segments up to 1·5 mm. broad .. BOREALIS
         4. Orifice less than the width of the body .. CUPREATUM
   2. Corolla-segments pink; style absent .. .. ASTYLUM

1. Capsule 5-locular; calyx-segments and stigmas 5.
   6. Orifice equalling the width of the body, glabrous.
      7. Pellucid area clear.. .. PELLUCIDUM
      7. Pellucid area pigmented .. PELLUCIDUM var. TERRICOLOR
   6. Orifice about half the width of the body, ciliate.
      8. Orifice depressed; corolla-segments white. AREOLATUM
      8. Orifice not depressed; corolla-segments pink. LITHOPOIDES

In series 4, *Minuscula* Schwant., of the subgenus EUCONOPHYTUM Schwant. the type species, **C. minusculum** N. E. Br., has the same floral structure as that of the subgenus FENESTRATA, in that the staminodes or "contrasting inner corolla-segments" are present and the stamens and stigmas concealed in the corolla-tube. This series contains 16 species, but only **C. herrei, C. luckhoffii** and **C. reticulatum** agree in their flower-structure with the type-species (see L. Bol., Mesemb. 3 : pl. 14, C and D and pl. 44, F and M). Of the remaining 12 species listed, **C. obscurum** and **C. wiesemannianum** were described without flowers and cannot be placed; **C. ectypum, C. fulleri, C. pulchellum** and **C. vanheerdei** have the floral characters of the *Wettsteiniana*, series 3 of this subgenus. But **C. edwardsiae, C. eenkokerense** and **C. turrigerum** belong to the subgenus DERENBERGIA. Staminodes are also absent and the stamens exserted in **C. barbatum, C. comptonii** (see L. Bol., Mesemb. 3 : pl. 44, B), and in **C. auriflorum** are not recorded. These species require further study before deciding whether any of the existing series could be suggested for their reception or new ones be created.

The geographical distribution of the *Minuscula*, thus emended, is confined to the Clanwilliam, Vanrhynsdorp and Calvinia Divisions. The type-locality of **C. luckhoffii** is Citrusdal, and it also occurs near Nieuwoudtville, up to 6 miles N.E., and 17 miles N.W., of the town (*F. J. Stayner*); **C. herrei** is also found at Nieuwoudtville, near the town and N. and S. of the escarpment (*F. J. Stayner*), as well as on the Giftberg (the type-locality) and the summit of Vanrhyns Pass; **C. minusculum** has been collected at various points in the Pakhuis Pass (*Stayner* and *Littlewood*) and between Clanwilliam and Citrusdal (the type-locality?); **C. reticulatum** is known only from its type-locality on the Cedarberg in the Clanwilliam area.

KEY TO THE SPECIES OF THE SERIES MINUSCULA

1. Body 2-lobed .. .. LUCKHOFFII
1. Body not 2-lobed.
   2. Apex of the body concave; orifice linear .. .. HERREI
   2. Apex of the body not concave; orifice circular or rhomboidal.
      3. Calyx-segments and stigmas 5*; resting-sheath reticulate, apex of body truncate; orifice circular .. .. RETICULATUM
      3. Calyx-segments and stigmas 4; resting-sheath not reticulate; apex of body sloping away from the orifice .. .. .. MINUSCULUM

*C. reticulatum is the only species with 5 calyx-segments and stigmas.

The flower-structure of **C. minutum**, **C. pearsonii** and **C. nudum** is also like that of the subgenus FENESTRATA, the staminodes being present and the stamens and stigmas concealed in the corolla-tube. These species have been placed in the series *Wettsteiniana*, which they resemble in vegetative characters only. But they form a distinct series, *Minuta* Littlew., which with the FENESTRATA and MINUSCULA constitute a new subgenus based on floral characters. This subgenus requires a comprehensive name and CELATISTAMINA (the concealed-stamened) is considered appropriate, with **C. minutum** (Haw.) N. E. Br., the oldest species known to have this characteristic, as the type-species. In this very large and fascinating genus these 3 small series contain all the species known to have this structure.

Subgenus CELATISTAMINA Littlew. Type-species **C. minutum** (Haw.) N. E. Br.

KEY TO THE SERIES OF THE SUBGENUS CELATISTAMINA

1. Leaves fenestrate; corolla-segments pink or white .. .. .. FENESTRATA
1. Leaves not fenestrate; corolla pink or purplish pink.
   2. Bodies with raised markings .. .. MINUSCULA
   2. Bodies smooth, sometimes spotted .. .. MINUTA

The *Minuta* extend from Vanrhynsdorp to approximately 10 miles N. of Bitterfontein, with one collection recorded from the Monazite mine, growing in open quartz-strewn ground, either in the open or under bushes, or occasionally in series of shale-crops.

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NOMENCLATURE SECTION

Proposals regarding the International Code of Botanical Nomenclature (1961) must be submitted to the Rapporteur-général, Dr. J. Lanjouw, Lange Nieuwstraat 106, Utrecht, Netherlands, before 1 October 1963. All proposals will be published in Taxon.

The nomenclature proposals will be presented to the Congress by the Rapporteur-général, in a "Synopsis of Proposals" to be published in January 1964.

The sessions of the Nomenclature Section will be held in Edinburgh, Great Britain from July 29th until August 1st. The dates for the Congress itself are August 3rd to August 12th.

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THE IDENTITY OF *KNIPHOFIA PUMILA* (AIT.) KUNTH AND *K. CARINATA* C. H. WR.

L. E. Codd

(*Botanical Research Institute, Department of Agricultural Technical Services, Pretoria*)

(With Plates XXII and XXIII)

1. **K. pumila** (Ait.) Kunth

Ever since an intensive study of the South African species of *Kniphofia* was resumed some years ago, a problem has been posed by the illustrations of *Tritoma pumila* in the Botanical Magazine t.764 (1804) and in Loddiges' Botanical Cabinet 5 : t.444 (1820). These are said to illustrate a species originally from the Cape, but no material in South Africa has been found to match them. Recently the probable type of *K. pumila* (Ait.) Kunth has been seen in the Herbarium of the British Museum (Natural History). It is a sufficiently good match of the above plates and confirms the view that *K. pumila* has been wrongly interpreted by monographers of the genus.

In May, 1958, I received some notes from Mr. J. N. Lythgoe of Trinity College, Cambridge, on the *Kniphofia* plants seen during his expedition to Abyssinia. He drew attention to the similarity between certain Abyssinian and South African species and, in particular, to the possibility of the Abyssinian species, *K. comosa* Hochst., being a synonym of the supposedly South African *K. pumila*. Further investigation supports this view and the results are now presented in some detail in order to clarify the position. I am grateful to Miss M. D. Gunn, Librarian of the Botanical Research Institute, Pretoria, for information relating to the early botanical collectors in Africa.

Kniphofia pumila (Ait.) Kunth, Enum. Pl. 4 : 552 (1843), excl. syn. *Veltheimia abyssinica* Red.; Bak. in Journ. Linn. Soc. 11 : 363 (1871); Journ. Bot. Lond. 23 : 277 (1885), partly, excluding South African specimens; Flora Cap. 6 : 279 (1896), partly, excluding South African specimens; Berger in Pflanzenreich IV, 38 : 45 (1908), partly, excluding South African specimen.

Aletris pumila Ait., Hort. Kew. 1 : 464 (1789); Mill., Dict. ed. 9 (1807).

Veltheimia pumila (Ait.) Willd., Sp. Pl. 2 : 182 (1799).

Tritoma pumila (Ait.) Ker Gawl. in Bot. Mag. t.764 (1804); Ait.f., Hort. Kew. ed. 2, 2 : 290 (1810); Lodd., Bot. Cab. 5 : t.444 (1820).

Tritomanthe pumila (Ait.) Link, Enum. 1 : 333 (1821); Schult. in Roem. & Schult., Syst. Veg. 7 : 631 (1829), partly, excl. syn. *Veltheimia abyssinica* Red. and Vel. d. Mus. d'Hist. Nat. 8.55.

Kniphofia comosa Hochst. in Flora 31 (1844); Bak. in Bot. Mag. t.6569 (1881); Fl. Trop. Afr. 7 : 452 (1898); Berger, l.c. 45 (1908).

K. infundibularis Bak. in Journ. Bot. Lond. 23 : 277 (1885); Flora Cap. 6 : 277 (1896); Berger, l.c. 44, t.17A (1908).

The protologue of *Aletris pumila* Ait., Hort. Kew. 1 : 464 (1789), reads as follows: "A. acaulis, scapo breviore foliis linearibus acute carinatis. Small Orange-flower'd Aletris. Nat. of the Cape of Good Hope. Mr. Fr. Masson. Introd. 1774. Fl. September–November." This description is insufficient for purposes of identifying a *Kniphofia*, but fortunately a specimen has been found in the B.M. Herbarium annotated: "Hort. Kew 1781, Aletris pumila" which may be regarded as the type specimen (Fig. 1). Although fragmentary, the specimen is nevertheless adequate, consisting of a portion of leaf, with smooth margins, 14·5 cm. long and 9 mm. wide, and four loose flowers. The flowers are funnel-shaped, 12·5 mm. long, narrow at the base, expanding abruptly to 6 mm. wide at the mouth. These are unlike the flowers of any species known to exist in South Africa. They are, however, matched by the following:

(*a*) The illustrations of *Tritoma pumila* (Ait.) Ker Gawl. in Bot. Mag. t.764 (1804) (see Fig. 2) and Lodd., Bot. Cab. 5 : t.444 (1820) referred to in the opening paragraph. Apparently no herbarium specimens of the figured plants were made, as none has been found, but the illustrations agree with the type specimen in the short, funnel-shaped flowers, which are orange to yellow in colour. In the description accompanying the Bot. Mag. plate, however, the leaf margin is described as being minutely scabrid.

(*b*) The type specimen of *K. infundibularis* Bak., which is from the Herbarium of Bishop Goodenough, acquired by the Royal Botanic Gardens, Kew, in 1880. According to Baker in Flora Capensis 6 : 278 (1896) it was "dried from Kew Gardens about 1780", though this information does not appear on the sheet. In this specimen, the perianth is distinctly funnel-shaped, about 11 mm. long, narrow at the base and expanding abruptly to 8 mm. wide at the mouth.

PLATE XXII. Type specimen of *Kniphofia pumila* (Ait.) Kunth in BM (natural size).

PLATE XXIII. *Tritoma pumila* (Ait.) Ker Gawl. in Bot. Mag. t.764 (1804).

Baker in Journ. Bot. Lond. 23 : 277 (1885) describes the flowers as being "all yellow".

(*c*) Specimens of *K. comosa* Hochst., an Abyssinian species. The type of *K. comosa*, which is *Schimper* 1192 from Abyssinia, was evidently seen in Berlin Herbarium by Berger, l.c., who published a sketch of two flowers in his monograph. This specimen can no longer be found and must be presumed to have been destroyed, though the majority of *Kniphofia* types in Berlin survived. There are, however, two sheets of this number in Kew Herbarium which agree in essentials with the type of *K. pumila* in B.M., as does the illustration of *K. comosa* in Bot. Mag. t.6569 (1881). The following specimens, now classified as *K. pumila*, were among those seen at Kew: Abyssinia, *Schimper* 1145 (2 sheets); 1192 (2 sheets); Ethiopia, Temcha gorge, *Lythgoe* 721; 722; ex Hort. Elwes, "type specimen of Bot. Mag. t.6569".

On this evidence, *K. comosa* is relegated as a synonym of *K. pumila*, and it now seems clear that the latter did not originally came from the Cape of Good Hope, as stated by Aiton, but from Abyssinia. The question arises whether any collector could have introduced the species from Abyssinia at such an early date. Such a role could have been filled by James Bruce, who spent the years from 1769 to 1772 in north Africa, and who returned to Marseilles in March 1773. According to "The Banks Letters" edited by Warren R. Dawson, p. 177 (1958), Bruce "sent last October (1773) through the Consul at Leghorn a collection of seed, chiefly collected in Abyssinia, directed to Mr. Eaton (Aiton) at the King's Garden at Kew and hopes that they have arrived." Bruce eventually reached England in 1774, the year recorded by Aiton for the introduction of *K. pumila*.

In 1774 Francis Masson was at the Cape and there is evidence that, about this time or a few years later, he was responsible for the introduction of at least one *Kniphofia* into England. Thus there is a basis for the confusion which arose regarding the origin of the cultivated plants of *K. pumila*. The real Masson plant is preserved as a specimen, also in the B.M. Herbarium, annotated "Aletris uvaria ? Hort. Kew 1786 (e Cap b. Spei per Masson 1780)." To one who has studied the genus closely, this specimen is clearly distinct from the specimen labelled "Hort. Kew 1781, Aletris pumila." It has longer flowers which are 18—20 mm. in length, narrow at the base and expanding to 5 mm. wide at the mouth, and the flowers are not distinctly funnel-shaped. From a knowledge of modern material, this specimen is obviously a representative of the South African species *K. ensifolia* Bak., of which *K. rivularis* Berger is a synonym and *K. tuckii* Bak. is no more than a variety.

It is apparent that Baker came to include this 1786 specimen in his concept of *K. pumila* and later applied the name solely to the South African plants.

Thus, in Journ. Linn. Soc. 11 : 363 (1871), he describes the perianth of *K. pumila* as being 6—8 lin (12·5—17 mm.) long and 2½—3 lin (5—6 mm.) wide at the mouth though, in this work, he does not cite any specimens. In Journ. Bot. Lond. 23 : 277 (1885) and in Flora Capensis 6 : 279 (1896), he describes the perianth as being ⅝ to ¾ inch (16—19 mm.) long and ⅙ inch (4 mm.) wide at the throat while, in addition, he cites *Burchell* 2554 from "Bechuanaland" and *Shaw* s.n. from Colesberg. Both these specimens have been examined and should be included in *K. ensifolia* Bak. *sens. lat.* Furthermore, when he described the closely related *K. tuckii* in the Gardener's Chronicle 13 : 68 (1893), he enlarges on his views in the following terms: "For many years he (Herr Max Leichtlin) has been trying to re-introduce *K. pumila*. At his instigation Mr. Tuck recently undertook an expedition to the province of Colesberg, where *K. pumila* was last gathered by the late Dr. John Shaw. He brought home the present plant, which, although nearly allied to *K. pumila* (of which we have at Kew fine specimens collected by Burchell) differs from it . . . etc." Having altered the concept of *K. pumila* to agree with these South African specimens, it is not surprising that Baker, in 1885, redescribed the true *K. pumila* under the appropriate name *K. infundibularis*, basing his species on Bishop Goodenough's specimen acquired by Kew in 1880, and which was gathered in Kew Gardens in 1780, about the same time as the type specimen of *K. pumila*. Berger, in his monograph in Pflanzenreich IV, 38 : 45 (1908), followed Baker's treatment of *K. pumila*, giving the perianth measurements as 11—18 mm. long and 4—6 mm. wide at the mouth. He, however, cites only the *Burchell* specimen and expresses doubt as to whether its identification as *K. pumila* is correct.

The 1786 specimen discussed above, annotated "Aletris uvaria ?" and now identified as *K. ensifolia* Bak. was, of course, available to Aiton and the question may be asked if Aiton did not also include this specimen of South African origin in his concept of *K. pumila*, or even possibly base *K. pumila* exclusively upon it. As already pointed out, his protologue of *K. pumila* is extremely vague, but his reference to orange flowers excludes *K. ensifolia* from further reckoning; also, *K. pumila* flowered in the English autumn (September–November) and, while not as conclusive (making allowance for the changed conditions to which cultivated plants are subjected), this may be cited as additional evidence against *K. ensifolia*, which is a spring-flowering species. The normal flower colour of *K. ensifolia* is well illustrated in the Botanical Magazine, t.7644 (1899) under the name *K. tuckii* Bak., in Flowering Plants of South Africa t.866 (1942) under the name *K. rivularis* Berger, and in Letty, Wild Flowers of the Transvaal t.19 (1962). The buds are red and the flowers become creamy-white to greenish-white as they open. It is significant that the plant figured as *K. tuckii* flowered at Kew in the month of April, thus retaining its spring-flowering character. There is, therefore, no evidence that Aiton had

any material of the South African species *K. ensifolia* in mind when he described *Aletris pumila.*

To return to the plate of *Tritoma pumila* (Ait.) Ker Gawl. in Bot. Mag. t.764 (1804), a feature which initially added to the difficulty of interpretation may be seen in the globose structures at the base of the inflorescence. These were, at first, interpreted as round, apparently baccate, fruits, which would mean excluding the plant from the genus *Kniphofia.* Finally the probable explanation was supplied by a specimen of *K. isoëtifolia* Hochst., collected in Abyssinia by Dr. G. W. Reynolds during his *Aloe* studies and cultivated at his home in Johannesburg in 1954. In this specimen the raceme was remarkable in that the flowers opened from the apex downwards. By analogy, the round structures at the base of the inflorescence in the above Bot. Mag. plate would represent flower buds. Confirmation is provided by Mr. Lythgoe's observations in Abyssinia. He records that the observed inflorescences of both *K. isoëtifolia* and *K. pumila* were basipetal. The only published reference to this remarkable characteristic so far found is by N. E. Brown in 1914 and this is discussed under the next heading.

2. **K. carinata** C. H. Wr.

K. carinata C. H. Wr. provides a case almost parallel to *K. pumila.* C. H. Wright described the plant in 1914 as "a South African species for the introduction of which horticulture is indebted to Miss Ayliff of Rose Cottage, Grahamstown, by whom seeds were presented to Kew in 1892." It is not matched by any material indigenous in South Africa and can scarcely be separated from the Abyssinian species, *K. leichtlinii* Bak. ex Hook.f. As there is no valid reason for maintaining it, it is placed in synonymy under the latter species. In the absence of clear evidence it may be conjectured that either Miss Ayliff originally received the species from Abyssinia (which is unlikely), or that the garden records at Kew may have been at fault.

K. leichtlinii Bak. ex Hook.f. in Bot. Mag. t.6716 (1883); Bak. in Fl. Trop. Afr. 7 : 452 (1898); Berger in Pflanzenreich IV, 38 : 46, t.17B, C (1908).

K. carinata C. H. Wr. in Bot. Mag. t.8545 (1914).

This species is closely allied to *K. pumila*, differing mainly in the longer perianth, which is 18—22 mm. long. N. E. Brown, in Gard. Chron. Ser. 3, 56 : 410 (1914), makes the following interesting comment while discussing a plant cultivated at Kew under the name *K. comosa*: "The peculiarity of this plant (shared also by typical *K. leichtlinii*, the true *K. comosa* and *K. carinata*) is that when the stem bears only one spike, instead of the lowest flowers of the spike opening first, as in the other kinds in cultivation, it is the uppermost

flowers on the spike which mature and expand first, whilst the lower are in bud. But when the stem branches and bears one or two lateral spikes, the flowers of the terminal or main spike open as just described from above downwards, whilst on the lateral spikes the reverse is the case, the lowest flowers opening first . . . as is normally the case in all the other kinds in cultivation." Such remarkable variation in what one would regard as a fundamental character deserves further investigation. If the plate of *K. carinata* in Bot. Mag. t.8545 (1914) is examined closely, it will be seen that it apparently has buds at the apex and at the base of the inflorescence. If this is actually the case, it would appear to be a transition between a basipetal and an acropetal inflorescence.

A NEW ALOE FROM MADAGASCAR

G. W. Reynolds

(With Plates XXIV and XXV)

Aloe rauhii Reynolds. Species nova, forsitan in Subsect. *Parvae* pertinet; nulli alii arcte affinis; sectionem propriam constituere debet, ut videtur.

Planta parva, succulenta, acaulescens, caespitosa. *Folio* c. 16—20, rosulata, lanceolato-deltoidea, 7—10 cm. longa, basi 15—20 mm. lata, sensim acuminata, patentia; *supra* canaliculata, viridula, copiose maculata; *subtus* convexa, copiose maculata; marginibus dentibus albidis cartilagineis ·5 mm. longis, 1—2 mm. distantibus armata.

Inflorescentia simplex, c. 30 cm. alta, interdum 1-ramosa. *Pedunculus* basi plano-convexus et 4 mm. latus; vacue bracteatus, bracteis albidis ovato-acutis 6 mm. longis, 3 mm. latis. *Racemus* cylindricus leviter acuminatus, laxe c. 16-floribus, c. 7—8 cm. longus, 4 cm. diametro. *Bracteae* ovato-acutae, 4·5 mm. longae, 2 mm. latae. *Pedicelli* 10 mm. longi. *Perianthium* pallide coccineum, c. 25 mm. longum, basi breviter stipitatum, circa ovarium 5 mm. diametro; *segmenta exteriora* libera, obscure 3-nervata. *Antherae* 0—1 mm. exsertae. *Stigma* demum 1 mm. exsertum. *Ovarium* 4·5 mm. longum, 2 mm. diametro.

Hab. Madagascar, Tulear Province, 10 km. SE. of Ampanihy on sandstone rocks in dense bush, fl. 3 October 1961, W. Rauh 7594 holotype (K), isotype (HEID); plant coll. Rauh, cult. Mbabane, Swaziland, fl. 15 September 1963, Rauh et Reynolds 10114 (PRE).

This very distinctive and charming little new species is named after Professor Dr. W. Rauh (Heidelberg University, W. Germany), who discovered it in October 1961 on sandstone rocks, in dense bush about 10 km. SE. of Ampanihy, near the Tulear-Ambovombe main road in the dry south-western region of Madagascar. Professor Rauh found plants growing in groups with rosettes averaging 10 cm. across, and with inflorescences that were mostly simple although an occasional inflorescence was found with a short branch arising from below the middle.

A. rauhii does not appear to be closely allied to any other known species of Aloe in Madagascar, although in leaf characters only there may be some affinity with *A. bellatula* Reynolds, but this has longer narrower leaves and campanulate flowers only 13 mm. long.

In *A. rauhii* the perianth is 25 mm. long, slightly constricted trigonously above the ovary, thence slightly enlarging to the mouth, with outer segments

free to base, which separates it from other species in Madagascar. In floral characters *A. rauhii* might be allied to *A. deltoideodonta*, but the latter is a considerably larger plant, having very different leaves and a branched inflorescence.

I am greatly indebted to Professor Rauh for plants, photographs and much data concerning *A. rauhii* and other species of Aloe in Madagascar.

Description

Plant succulent, acaulescent, or with very short stem, forming dense groups, with rosettes averaging 10 cm. across.

Leaves up to 20, densely rosulate, lanceolate-deltoid, 7—10 cm. long, 15—20 mm. broad at base, gradually narrowing to an acute apex, the younger leaves suberectly spreading, the older spreading; *upper surface* canaliculate, grey-green, sometimes with brownish tinge, with numerous narrowly "H"-shaped spots scattered irregularly throughout; *lower surface* rounded, otherwise as the upper; *margins* with white cartilaginous edge armed with very small white cartilaginous deltoid teeth about ·5 mm. long, 1—2 mm. apart.

Inflorescence simple, or rarely with a short branch low down, 30 cm. tall.

Peduncle basally plano-convex and 4 mm. broad, terete upwards, brownish-maroon with a whitish waxlike bloom, with a few sterile bracts that are white, scarious semiamplexicaul, 6 mm. long, 3 mm. broad, 3—5-nerved.

Raceme cylindric slightly acuminate, laxly 12—18-flowered, about 7 cm. long, 4 cm. diam., open flowers nutant to pendulous.

Bracts ovate-acute, long-pointed, 4—5 mm. long, 2 mm. broad, white, scarious, 3—5-nerved.

Pedicels slender, 10 mm. long, the colour of the perianth.

Perianth rose-scarlet, paler at mouth, 25 mm. long, shortly stipitate at base, 5 mm. diam. across the ovary, very slightly constricted above the ovary, thence very slightly enlarging trigonously to an open mouth; *outer segments* free to base, obscurely 3-nerved; *inner segments* free, broader than the outer, with a scarlet keel throughout, the apices more obtuse and slightly more spreading than the outer.

Filaments lemon-yellow, filiform-flattened, the 3 inner narrower and lengthening before the 3 outer with their *anthers* in turn exserted 0—1 mm. *Style* lemon-yellow with *stigma* at length exserted 1 mm.

Ovary pale olive, 4·5 mm. long, 2 mm. diam.

Fruit 10—15 mm. long, 7 mm. diam. at middle.

PLATE XXIV. *Aloe rauhii* Reynolds. Plants × 3/10 in natural habitat, 10 km. SE. of Ampanihy, Tulear Prov., Southern Madagascar.

Photo—Prof. W. Rauh.

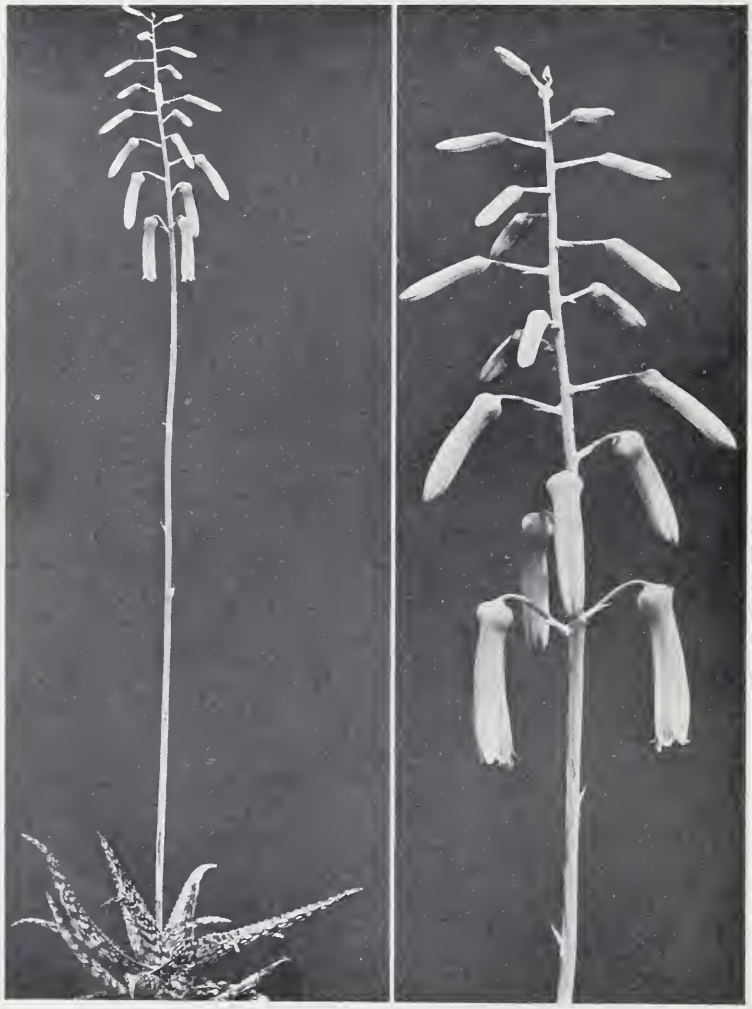

Fig. 1 Fig. 2

PLATE XXV. *Aloe rauhii* Reynolds.
Fig. 1. Cultivated plant × 1/2.
Fig. 2. Raceme × 1/1.

Photos—Prof. W. Rauh.

A CONTRIBUTION TO THE ECOLOGY OF CATHCART AND ENVIRONS WITH SPECIAL REFERENCE TO SLOPE EXPOSURE AND SOIL pH.

B. R. Roberts

(*Faculty of Agriculture, University of the Orange Free State, Bloemfontein*)

(With Plates XXVI to XXVIII)

ABSTRACT

The vegetation of three distinct veldtypes in different climatic regions of the Cathcart district is described in relation to environmental conditions and affinities to tropical and temperate floras. The localities investigated are the Black Kei river valley (alt. 2,800′, rain 435 mm.), Windvoëlberg (alt. 5,350′, rain 645 mm.) and Gaikaskop (alt. 6,300′, rain 1,064 mm.).

Plant lists are given of the most important species in each of the three localities, with special reference to the *Gramineae*. In the case of Windvoëlberg the meso- and xerocline communities are considered separately and differences in physiognomy and dominants are emphasised. The relationships between these communities and the semi-arid Kei valley savannah and the humid *Podocarpus* forest of the Amatole range is considered. Special reference is made to the distribution of the primitive *Encephalartos cycadifolius*.

Preliminary investigations into the pH and total salt concentration of the soil of opposing slopes indicate that there is no correlation between these factors and the distribution of the dominant species. The importance of slope exposure, primarily due to its influence on sunlight intensity and the resultant evaporation and soil moisture, is discussed in the light of relevant literature.

INTRODUCTION

The portion of the Amatole mountain range known as Windvoëlberg, which overlooks the village of Cathcart in the Cape Province, displays an unusual mixture of vegetation types and provides a striking example of the effect of slope exposure on the vegetation. This mountain rises to a height of 1,850 feet above the grassveld plains and is situated approximately midway between the hot dry valley of the Black Kei river and the more temperate high rainfall area of the Amatole range known as the Hogsback. (See accompanying map.) The change in climate and altitude within a distance of approximately 35 miles is accompanied by a significant change in vegetation which has an important influence on pastoral practices in that district.

The writer has had the opportunity of tracing the variations in vegetation from the two extreme types, in the Kei valley and at Gaikaskop respectively, to where the so-called sourveld (humid) and the sweetveld (semi-arid) meet. One such transitional area is a deep ravine in Windvoëlberg, which provides what must be one of the most striking examples of slope exposure in South Africa.

Specimens of the most important grasses and woody plants were collected on north-facing slopes in all three of the above-mentioned localities and at Windvoëlberg north- and south-facing slopes were compared floristically. Soil samples from opposing slopes were investigated for pH and total salt values at the latter locality.

Physical Features

The area concerned falls within the region of South Africa which is underlain by the geologic group known as the Karoo system. The Amatole range is made up almost entirely of dolorite although sandstone of the Beaufort series is found to a limited extent in the lower lying areas. The vegetation of the localities investigated on Gaikaskop and Windvoëlberg occur on dolorite (ironstone) while the sampling areas on the banks of the Black Kei river are underlain by sandstone. The sampling areas at the Black Kei river which were used in this investigation occur at an altitude of 2,800 feet above sea level, on the farm Grey Craig. The summits of Gaikaskop and Windvoëlberg are 6,300 feet and 5,349 feet respectively. The accompanying map indicates the undulating nature of the district and the gradual decrease in altitude from Gaikaskop to the Black Kei river.

Climate

The Gaikaskop area receives an annual rainfall of 1,064 mm. (Weather Bureau, 1950). According to Story (1952) who carried out a comprehensive plant ecological survey of the Keiskammahoek area of the Amatoles, 30 per cent of the rain which this area receives, falls during the winter. The nearby Hogsback forest station has an average of 105 rainy days per annum (Story, 1952). The large number of cloudy days and the frequent occurrence of thick mist in the Gaikaskop area result in considerably more mesophytic habitat conditions than the rainfall figure might indicate. In Table I the rainfall normals for stations occurring in the localities under consideration are given. Wolfridge is four miles south of Gaikaskop, Exwell Park is six miles from the Black Kei and the Cathcart forest station is on the Windvoëlberg.

TABLE I

Rainfall normals for the Cathcart area (Weather Bureau, 1950).

Station No.	Station	Lat.	Longt.	Alt.	Period Yrs.	Max. mm.	Min. mm.	Av. mm.
78/879	Wolfridge	32° 39′	27° 00′	4000′	52	1509	615	1064
101/192	Exwell Park . .	32° 12′	27° 07′	2900′	50	637	228	435
101/228	Cathcart Mountain Forest	32° 18′	27° 08′	3900′	45	879	320	645

FIG. 1. Map of Cathcart and Environs.

Temperature data for the area are incomplete since no readings are available for the Kei valley. The Gaikaskop locality enjoys a considerably cooler summer than is experienced in the Kei valley. At the former locality, January is the hottest month, with a mean daily maximum temperature of 71·9°F and an absolute maximum of 91·0°F. August is the coldest month with a mean daily minimum of 39·6°F and an absolute minimum of 28·0°F. The diurnal air temperature range is approximately 15° in winter and 21° in summer. This range is considerably less on mountain peaks such as Gaikaskop than in the valleys. Maxima in the lowlands are 15° higher than in the mountains on the average (Story, 1952). The winters are cold and windy with severe frost and snow as normal phenomena. Temperature inversion is an important ecological consideration in this locality.

As regards the Windvoëlberg locality, temperatures for Cathcart may be summarised as shown in Table II.

TABLE II

Temperatures (°C) for Cathcart (Goal, 1906–1950) (Weather Bureau, 1954).

Month	Mean of Daily Max.	Extreme Daily Max.	Mean of Daily Min.	Extreme Daily Min.	Range (Max.–Min.)
January	26·5	38·3	12·0	2·2	14·5
February	25·8	38·1	12·7	1·1	13·1
March	24·6	36·1	11·9	2·8	12·7
April	21·9	37·1	9·1	−1·1	12·8
May	18·8	30·6	6·4	−2·3	12·4
June	16·2	24·9	4·4	−4·4	11·8
July	15·8	26·0	4·3	−4·1	11·5
August	18·2	30·0	5·1	−5·2	13·1
September	20·5	33·3	6·3	−3·3	14·2
October	22·3	37·2	8·3	−2·8	14·0
November	23·8	36·1	9·3	0·6	14·5
December	25·3	37·9	11·2	2·8	14·1

The Kei valley is considerably hotter than the higher lying locality at the village of Cathcart, due presumably to the lower elevation and concave physical features in the former case.

The Vegetation

(i) *The Black Kei River Valley*

The semi-arid savannah of the valley is characterised by the dominance of *Acacia karoo* which causes encroachment problems on most farms in the valley. The most xerophytic communities of the valley are found on the steep north-facing stony slopes overlooking the river. Intense insolation, high evaporation

and runoff combine to form a habitat which is considerably more xeric than is the case at other sites in the valley.

The following grasses were recorded from the sampling area selected at site A on the accompanying map:

Setaria lindenbergiana, *Panicum maximum*, *Rhynchelytrum repens*, *Cenchrus ciliaris*, *Enneapogon scoparius*, *Bothriochloa radicans*, *Cynodon incompletus*, *Aristida barbicollis*, *Eragrostis curvula*;

Of the woody plants occurring at this site the most important are:

Acacia karoo, *Aloe ferox*, *Crassula portulacea*, *Grewia occidentalis*, *Euclea crispa*, *Euryops spathaceus*, *Ehretia rigida*, *Kalanchoe rotundifolia*, *Combretum erythrophyllum*, *Celtis africana*, *Zizyphus zeyheriana*.

Site A at which the above plants were collected is a steep krantz-like rock face of sandstone, typical of the habitats which overlook the Kei river in this district. (See Plate XXVI.)

(ii) *Gaikaskop*

Gaikaskop is a striking solitary dome-shaped mountain (site B on map) which supports a dense grassveld with trees virtually absent except in a number of small screes where stunted trees are common.

The grassveld is a short sourveld in which the following grasses were recorded:

Agrostis barbuligera, *Agrostis lacnantha*, *Aristida galpinii*, *Bromus speciosus*, *Cymbopogon validus*, *Danthonia drakensbergensis*, *Danthonia macowanii*, *Ehrharta calycina*, *Eragrostis capensis*, *Eragrostis curvula*, *Eragrostis racemosa*, *Elyonurus argenteus*, *Festuca caprina*, *Festuca caprina* var. *irrasa*, *Harpechloa falx*, *Helictotrichon hirtulum*, *Heteropogon contortus*, *Koeleria cristata*, *Lasiochloa longifera*, *Microchloa caffra*, *Pentaschistis thunbergii*, *Pentaschistis tysonii*, *Pentaschistis* sp., *Setaria flabellata*, *Themeda triandra*, *Trachypogon capensis*, *Tristachya hispida*, *Vulpia bromoides*, *Vulpia myuros*.

As may be deduced from the above list, the grassveld has both tropical and temperate affinities. The temperate genera *Danthonia*, *Ehrharta*, *Festuca*, *Lasiochloa* and *Pentaschistis* occur mainly near the summit and are characteristic of cool moist mountain tops in this region. The temperate affinity of the flora is also indicated by the abundance of schlerophyllous species such as the following which were collected above 5,500 feet:

Aster filifolius, *Arrowsmithia styphelioides*, *Cliffortia eriocephalina*, *Erica leucopelta*, *Erica caffrorum*, *Passerina montana*, *Phylica* sp. (cf. *P. galpinii* Pillans), *Restio* sp., *Stoebe vulgaris*.

These representatives of the macchia or *fynbos* flora only occur to any appreciable extent in this area in rocky high altitude environments and only reach full development when protected from fire for several seasons.

PLATE XXVI. Black Kei river valley (*Aloe ferox*, *Acacia karoo*, *Ehretia rigida*, *Cenchrus ciliaris*, *Kalanchoe rotundifolia*).

PLATE XXVIII. *Festuca* tussock grassveld on mesocline of Windvoëlberg.

The most important bushes and herbs collected on Gaikaskop are:

Asparagus microraphis, *Diascia rigescens*, *Geranium ornithopodum*, *Hebenstreitia* sp. (cf. *H. dentata*), *Helichrysum epapposum*, *Helichrysum fulgidum*, *Helichrysum splendidum* var. *montanum*, *Indigofera cuneifolia*, *Myrsine africana*, *Stachys aethiopica*.

With the exception of *Protea lacticolor* which appears not to be injured to any extent by fire, all the larger shrubs or trees occur in rocky screes or between boulders where they are protected from fire. *Kiggelaria africana* is the only tree of any size which is found on Gaikaskop. It grows to a height of 15—20 feet in this environment. Other woody species such as *Rhus pyroides* and *Buddleia salviifolia*, which grow into trees of considerable size in more favourable environments in South Africa, develop into stunted and often gnarled shrubs on Gaikaskop.

Arundinaria tesselata is a plant of special interest which was collected on the summit of Gaikaskop. This unusual plant, known locally as "Mountain Bamboo" or "*Rottangboom*", is unique in form amongst South African plants. It is also the largest South African member of the grass family known to the writer. Its culms reach a diameter of one inch at the base and a height of eight feet. Since the plant usually forms a dense thicket, up to a few yards in diameter, the basal leaves are lost and each culm generally only bears a brush of leaves on the topmost nodes. The leaves are short, broad and leathery and are apparently well adapted to the high winds which prevail in such sites.

Arundinaria tesselata has been collected by the writer only in moist high altitude habitats, and always in rock crevices on the summits of high mountains (Elandsberg (6,624 feet) and Hogsback (6,360 feet) of the Amatole range, Rensburgskop (7,300 feet) in the Harrismith district and Aasvoëlberg (7,250 feet) in the Zastron district).

The habitat conditions prevailing in the screes are undoubtedly moist for the greater part of the year as may be judged from the abundance of such moisture-loving genera as *Rubus*, *Agapanthus*, *Kniphofia* and *Zantedeschia*. High atmospheric moisture is indicated by the growth of *Usnea* ("Spanish Moss" or "Old Man's Beard") on the larger trees in the screes.

Although Gaikaskop was not investigated by Story (1952), the reader is referred to Story's comprehensive survey of the vegetation of the nearby Amatole mountains.

(iii) *Windvoëlberg*

The vegetation of Windvoëlberg displays several different associations whose floristic composition vary with aspect, slope, soil depth and altitude.

This investigation considers the vegetation of the north and south slopes of the deep ravine known locally as "the Kloof". Specimens were collected at

various sampling sites (at C on map) from the stream banks in the lowest portion of the ravine to the summits of the dolorite ridges on either side. The species listed below therefore represent a vertical cross section of the vegetation of the ravine.

(*a*) *Xerocline.* The north-facing slope is a rocky mountainside with a gradient of approximately 30°. The slope is strewn with dolorite boulders and the vegetation is characterised by the abundance of *Aloe ferox*, *Olea africana*, *Euclea crispa* and *Hyparrhenia hirta.* The abundance of *Aloe ferox* is typical of north and north-western slopes in the drier sweetveld areas of this region and this plant is generally regarded as an indicator of sweet grassveld in these areas.

Plate XXVII gives some indication of the physiognomy of the xerocline and the importance of the species mentioned above.

The majority of grasses which were collected on the xerocline are typical of hillside grassveld in many mixed grassveld areas of South Africa, namely:

Brachiaria serrata, *Cymbopogon excavatus*, *Cynodon dactylon*, *Eragrostis chloramelas*, *Hyparrhenia hirta*, *Rhynchelytrum setifolium*, *Themeda triandra.*

These species are often indicative of hot semi-arid conditions and are found to be typical components of hillside grassveld in many districts of the Orange Free State which receive between 15 and 20 inches of rain per annum. However, the upper reaches of the xerocline include several sourveld grasses with somewhat higher moisture requirements than the mixedveld species listed above, namely:

Digitaria diagonalis, *Eragrostis capensis*, *Tristachya hispida*, *Sporobolus indicus.*

The stoloniferous *Digitaria pentzii* is a valuable grazing grass and is particularly useful in binding the soil on steep slopes.

The following non-grasses are of general occurrence on the northern slopes in association with the above grasses:

Acokanthera oppositifolia, *Carissa bispinosa* var. *acuminata*, *Cassia* sp. nov. (Roberts No. 1728), *Clematis oweniae*, *Clutia pulchella*, *Colpoon compressum*, *Crassula portulacea*, *Crassula* sp., *Cussonia spicata*, *Cussonia paniculata*, *Diospyros scabrida* var. *cordata*, *Encephalartos cycadifolius*, *Euclea crispa* var. *crispa*, *Grewia* sp. (cf. *G. occidentalis*), *Helichrysum rugulosum*, *Hippobromus* sp., *Indigofera* sp., *Kalanchoe paniculata*, *Leonotis dubium*, *Maytenus cymosus*, *Myrsine africana*, *Olea africana*, *Plectranthus grandidentatus*, *Pterocelastrus tricuspidatus*, *Rhoicissus tridentata*, *Rhus dentata*, *Rhus lucida*, *Schistostephium crataegifolium*, *Scolopia mundii*, *Senecio deltoideus*, *Senecio glaberrimus*, *Solanum tormentosum*, *Venidium microcephalum*, *Vernonia natalensis.*

It is clear that this vegetation is derived to a large degree from the tropical flora, as seen by the abundance of genera such as *Cussonia*, *Diospyros*, *Euclea*, *Grewia*, *Maytenus*, *Olea* and *Rhus*. The mesophytic genera such as *Clutia* and *Myrsine* are limited to moist sites adjacent to large boulders.

The cycad *Encephalartos cycadifolius* is recognised as one of the most primitive types of plant in South Africa and for this reason its abundance on Windvoëlberg is of particular interest. It was first collected on Windvoëlberg by Drege (Pearson, 1905) and it appears from the literature (Anon, 1916) to be limited in distribution to the vicinity of Queenstown, Cathcart and Thomas River. (According to Henderson (1943) *Encephalartos cycadifolius* Lehm. is synonymous with the earlier species name *E. Frederici-Gulielmi* Lehm.) Although it is stated to be "abundant on doloritic hills" (Anon, 1916) in the above-mentioned districts, the present writer has observed *Encephalartos cycadifolius* growing in abundance on sandstone formations in several parts of the Cathcart district.

(*b*) *Mesocline.* The angle of slope of the south-facing aspect of the ravine varies a great deal but the general steepness is comparable to the northern aspect. The southern aspect is more densely wooded that the northern slope and supports a denser ground layer. The lower portion of the slope is a parkland with a dense grass sward growing between lichen-covered dolorite boulders, separating one copse of mixed evergreen forest from the other. Near the upper limits of the mesocline the vegetation changes to a tall tussock formation of coarse grass with only occasional lichen-covered trees (See Plate XXVIII).

On the lower portion of the mesocline the following grasses are of general occurrence:

> *Cymbopogon excavatus*, *Cymbopogon plurinodis*, *Digitaria diagonalis*, *Eragrostis capensis*, *Eragrostis chloramelas*, *Eragrostis curvula*, *Festuca longipes*, *Helictotrichon turgidulum*, *Koeleria cristata*, *Themeda triandra*, *Tristachya hispida*.

In comparison with the xerocline the absence of *Hyparrhenia hirta* from the mesocline is conspicuous and completely alters the general character of the grassveld. The higher lying tussock community is dominated by *Festuca costata*, with *Cymbopogon validus* abundant. *Ehrharta calycina* and *Pentaschistis* sp. are common in this habitat too but are less noticeable as a result of their being overshadowed by the tall tussocks of *Festuca* and *Cymbopogon*.

Although the general physiognomy of the mesocline is strikingly different from that of the xerocline (compare Plates XXVII and XXVIII), the majority of plants which occur on the xerocline are also found on the mesocline. The most important trees on the mesocline are:

> *Buddleia salviifolia*, *Cussonia paniculata*, *Diospyros scabrida* var. *cordata*,

Euclea crispa var. *crispa*, *Heteromorpha trifoliata*, *Olea africana*, *Pittosporum viridiflorum*, *Rapanea melanophloeos*, *Rhamnus prinoides*, *Rhus lucida*, *Rhus pyroides*.

With the exception of the species of *Diospyros*, *Euclea* and *Olea*, all the above trees have been observed by the writer to be typical components of the moist *Podocarpus* forest in the Hogsback-Katberg region of the Amatole escarpment. Their success as an association on the mesocline of Windvoëlberg indicates the significant influence which slope exposure must exert on the microclimate and especially on soil moisture.

Common shrubs, climbers and herbs collected on the mesocline are:

Asparagus virgatus, *Berkheya carduoides*, *Cineraria lobata*, *Chrysanthemoides monilifera*, *Clematis oweniae*, *Cliffortia serphyllifolia*, *Clutia pulchella*, *Conyza pinnata*, *Crassula vaginata*, *Diascia rigescens*, *Eriocephalus punctulatus*, *Euryops tenuissimus*, *Haplocarpa scaposa*, *Helichrysum adscendens*, *Helichrysum fulgidum*, *Lebeckia* sp., *Melianthus insignis*, *Myrsine africana*, *Pelargonium querifolium*, *Polemannia grossulariaefolia*, *Psoralea caffra*, *Psoralea pinnata*, *Rhoicissus microphylla*, *Rhus dentata*, *Scabiosa columbaria*, *Schistostephium crataegifolium*, *Senecio glaberrimus*, *Senecio* sp., *Stachys aethiopica*.

The growth form of Clutia and Myrsine on this slope is markedly more robust than on the xerocline.

Although the ground layer requires considerably more investigation before a complete check list of the vegetation may be compiled, the above lists give a good indication of the type of vegetation occurring on Windvoëlberg.

(*c*) *The relation of soil pH and microclimate to plant distribution.* Although the differences in vegetation of opposed slopes is a common phenomenon, the causes of such differences vary from place to place. Soil acidity is one factor which is frequently quoted as influencing vegetation type. The relation of soil acidity to plant distribution has been investigated by Wherry (1922), Olsen (1923), Kurz (1923), Pearsall (1924) and Salisbury (1925). Attention was first drawn to the ecological significance of soil acidity in South Africa by Bews and Aitken (1922). Both Olsen's field studies and his experiments suggest that the hydrogen ion concentration of the soil determine to a large extent the floristic composition of its plant covering. In the words of Tansley and Chipp (1926), "It has been shown that soil reaction is one of the most important factors determining the distribution of many species and communities of plants." These authors also maintain that stratification of pH leads to surface pH being lower than subsoil pH, which may result in plants of different pH tolerance growing in association.

In the present investigation, replicated samples of top soil (0—9″) were taken at representative sites on north- and south-facing slopes and analysed

by the glass electrode method (in water) for pH and by the electrical resistance method for total salts. The results obtained from duplicate analyses of each sample are recorded in Table III:

TABLE III

pH and Total Salt Concentration of Soils from Windvoëlberg, Cathcart, C.P.

Sample No.	Aspect	pH	Resistance (ohms)
1	North facing	6·00, 6·00	1240, 1240
2	North facing	6·15, 6·15	1180, 1180
3	South facing	6·35, 6·35	1320, 1320
4	South facing	6·10, 6·10	1500, 1500

Although these limited data do not justify definite conclusions, it is noteworthy that, since resistance is inversely related to salt concentration, the mesocline appears to have a lower salt concentration and a somewhat higher pH than are found on the xerocline.

Discussion

The tendency indicated by the pH values above is contrary to the expected results when considered in the light of our knowledge of plant density, runoff and leaching on xero- and mesoclines. The writer has investigated the soil pH in a similar situation on the Thaba'Nchu mountain at an altitude of 7,000′ in the south-eastern Orange Free State. In the latter case, the north- and south-facing slopes of a steep dolorite "knife-edge" support strikingly different plant communities and in this case the pH of the topsoil of the xerocline was 7·00 and of the mesocline 6·05, i.e. almost one pH unit difference.

In the absence of significant differences in soil acidity, explanation of the differences in botanical composition of the north- and south-facing slopes of Windvoëlberg may be sought in the differences in microclimate which occur between such exposures. Aitken (1922) has clearly demonstrated the significant differences in microclimate on such slopes in the Midlands of Natal; his results are summarised in Table IV:

TABLE IV

Diurnal Microclimatic Data for a Hill near Pietermaritzburg (Aitken, 1922).

Factor	North-facing slope	South-facing slope
Sunlight intensity ..	146 mg. iodine/day	107 mg. iodine/day
Evaporation	39 cc. water	22 cc. water
Max. Air Temperature	26·6°C	23·25°C
Max. Soil Temperature	25·2°C at 2″	13·05°C at 2″
Soil Moisture	12·03%	25·43%

It is known that sunlight intensity is the primary factor which results in higher air and soil temperatures, which lead to higher evaporation and the resultant lower soil moisture on northern slopes. Although in Aitken's case sunlight intensity and evaporation were in a ratio of 2 : 3 and 1 : 2 on opposing slopes, soil moisture on the xerocline was less than half that on the mesocline.

Windvoëlberg presents a similar case to the above and there is little doubt that soil moisture studies on Windvoëlberg would indicate similar trends for the above reasons. The principles involved in the determination of physiognomy and floristic composition of opposing slope exposures appear to hold good in the majority of cases in South Africa where the beneficial effect of lower sunlight intensity on soil moisture, results from the direction and angle of slope as described by Roberts (1961) in referring to the Thaba'Nchu area of the Orange Free State.

ACKNOWLEDGEMENTS

The writer is indebted to the National Herbarium for the identification of certain specimens; to Mr. M. T. Mey for soil analyses and to Mr. W. R. Roberts for assistance in soil sampling in the field.

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TWO NEW SPECIES OF AMARYLLIDACEAE

W. F. Barker

(*Curator, Compton Herbarium, National Botanical Gardens of South Africa, Kirstenbosch*)

(With Plates XXIX–XXXII)

Boophane pulchra Barker. sp. nov. (Amaryllidaceae)

Bulbus magnitudinis moderatae, globosus, tunicis cartilagineis indutus. *Folia* 6, hysterantha oblonga obtusa, humo adpressa. *Pedunculus* robustus, circiter 6—20 cm. altus. *Umbella* ad 70-flora *Pedicelli* 4—8 cm. longi, erecti. *Perianthium* carbunculo-rubrum; segmenta aequalia, anguste oblonga obtusa, 2·6 cm. longa, 8 mm. lata, erecta, in tubo 4—5 mm. longo adnata. *Stamina* erecta quam segmenta longiora, 3·3 cm. longa; filamenta filiformia ad tubum perianthii adnata. *Ovarium* obtuse angulatum, mox latum et apice acute angulatum, sensim ad pedicellum reductum. *Capsula* membranacea ad 3 cm. lata et 5 cm. longa.

Bulb medium sized, globose covered with brownish cartilaginous tunics, neck short, 2 cm. long. *Leaves* 6, hysteranthous, 13—20 cm. long, up to 6·5 cm. broad, oblong, subacute, smooth, green with narrow red margins, two-ranked when emerging, but becoming completely adpressed to the surface of the ground and spreading. *Peduncle* stout varying in length from 6—20 cm. high, up to 2 cm. diam., slightly compressed, tinged red. *Spathe valves* 2, up to 6 cm. long and broad, ovate, obtuse or slightly emarginate, purplish-red. *Umbel* up to 20 cm. diam., up to 70-flowered. *Pedicels* reddish-brown, 4—8 cm. long, in young heads about 2 mm. diam. at base, the outer ones curving upwards so that the flowers are all erect and more or less at the same level. *Perianth* light ruby red, actinomorphic; segments 2·6 cm. long and up to 8 mm. broad in the upper half, narrow oblong obtuse, erect, adnate into a tube 4—5 mm. long. *Stamens* up to 3·3 cm. long, erect, longer than the segments; filaments filiform, adnate to the perianth tube; anthers dark, up to 3 mm. long. *Style* erect a little shorter than the stamens. *Ovary* obtusely angled in the very young stage, soon becoming broadly angled at the apex, tapering gradually into the pedicel. *Capsule* membranous, up to 3 cm. broad at the apex, emarginate, 5 cm. long. In the fruiting stage the pedicels straighten out and especially in the plants with the longer peduncles, they radiate out to form a large globose head.

HOLOTYPE. *W. F. Barker* 7311 in Compton Herbarium, National Botanic Gardens, Kirstenbosch (flowers and fruits) May 1951; *W. H. Hodge* A-156 in Compton Herbarium (leaf) March 1952.

NAMAQUALAND. North of Darter's Grave, *W. F. Barker* 7311 (flowers and fruits) May 1951 (NBG); *W. H. Hodge* A-156 Hort. Glenn Dale, Beltsville, U.S.A. (leaf) March 1952 (NBG); Hort. Longwood Gardens U.S.A. P.I. 196775 (= *Hodge* A-156) (flowers) July 1959, (fruit) Aug. 1959, (leaf) Dec. 1959 (Longwood Gardens, U.S.A.); Darter's Grave *A. J. Middlemost* 2084 (fruits) May 1960 (NBG); Darter's Grave, *W. F. Barker* 9866 (flowers and young fruits) Aug. 1963 (NBG), Hort. Compton Herbarium (leaves) Aug. 1963 (NBG).

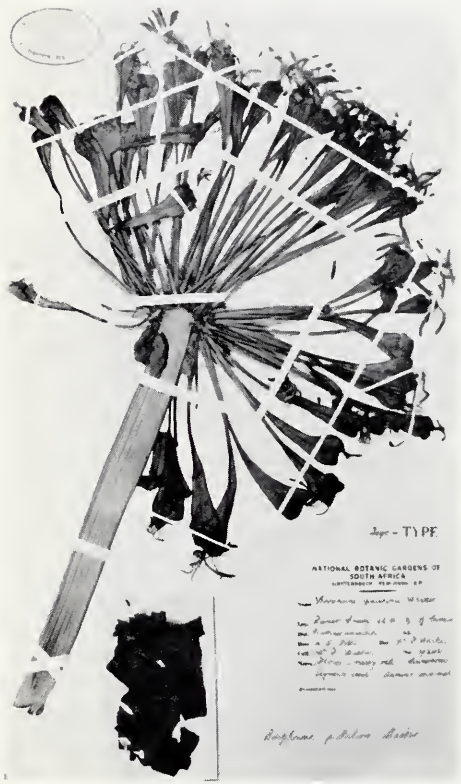
As far as is known this attractive and conspicuous plant has only been recorded from the vicinity of Darter's Grave, 22 miles North of Garies in Namaqualand.

It was first collected in May 1951, when Mr. A. J. Middlemost and I accompanied Dr. W. H. Hodge, then of the United States Department of Agriculture, on an expedition in search of plants which might contain cortisone. Herbarium specimens of the flowers and mature fruits were made at the time, and the accompanying photograph of the young inflorescence was taken by Dr. Hodge in the field.

With its actinomorphic flowers and angled fruits, the plant was identified as a possible undescribed species of Boophane. Unfortunately due to an oversight, no bulbs were kept at Kirstenbosch to grow for leaves, and when the bulbs grown at the Glenn Dale Plant Introduction Station, in Beltsville U.S.A. came into leaf in 1952, it was found that a mixture of bulbs with two distinct kinds of leaves were included under the same number, and there was some doubt as to whether the erect or the prostrate type corresponded with the original flowering and fruiting specimens.

It was not until Dec. 1959 that Dr. Hodge was able to send complete herbarium material, confirming that the prostrate leaves belonged to our plant. However the cultivated bulbs which had been moved again, this time to the Longwood Gardens, Pennsylvania U.S.A., had obviously deteriorated and the specimens were no longer typical. We therefore decided to make a hurried visit to Darter's Grave for more specimens in May 1963, when we were fortunate in finding some bulbs still in flower. Herbarium Topotype specimens were collected, bulbs were brought back to be grown at the Compton Herbarium, and it has now been possible to complete the description.

Boophane pulchra appears to be most closely allied to *Boophane haemanthoides* Leighton (*Boophone haemanthoides* Leighton) from Saldanha Bay, which differs from the other species in having erect perianth segments, in the former species however the perianth segments are much broader and the tube



BOOPHANE PULCHRA Barker

PLATE XXIX—FIG. 1.

Topotype sheet, Barker 9866 (young fruits) in Compton Herbarium.

PLATE XXIX—FIG. 2.

Topotype sheet, Barker 9866 (old inflorescence and flowers) in Compton Herbarium.

PLATE XXX—FIG. 1.
Young inflorescence, Barker 7311. Photo: W. H. Hodge.

PLATE XXX—FIG. 2.
Leaves of Barker 9866, grown at Compton Herbarium.
BOOPHANE PULCHRA Barker

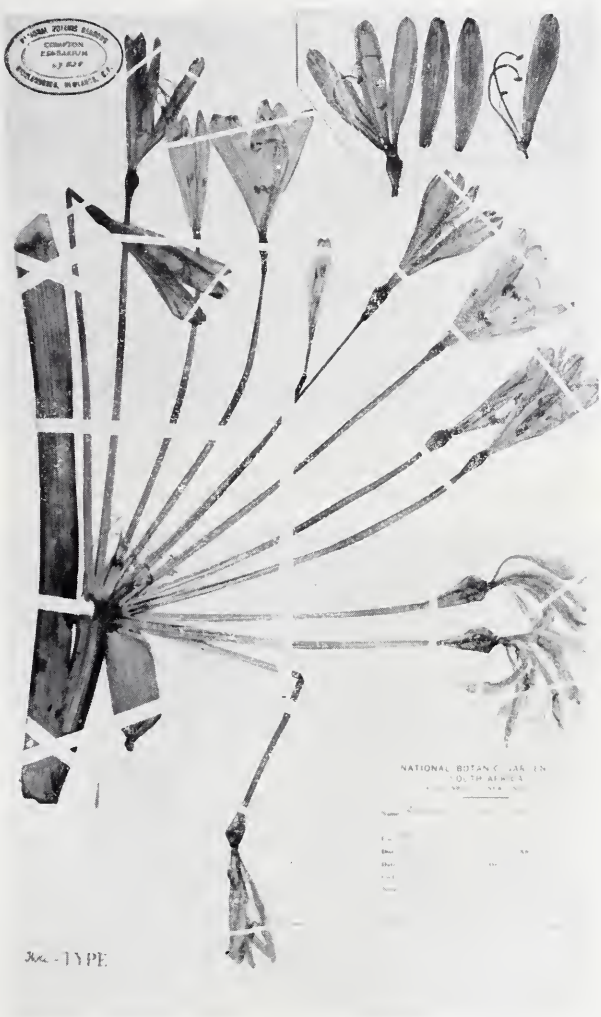


PLATE XXXI.
Holotype sheet in Compton Herbarium.
BRUNSVIGIA HERREI Leighton ex Barker

PLATE XXXII—FIG. 1.
Fully developed inflorescence.

PLATE XXXII—FIG. 2.
Leaves: neck of bulb exposed above ground.
BRUNSVIGIA HERREI Leighton ex Barker

is not angled, while the spathe valves are smaller in proportion to the umbel, and the capsules are much larger and longer in proportion to their width.

Unfortunately the set of the leaves in *Boophane haemanthoides* was not described and so no comparison can be made with those of *Boophane pulchra*, which is unique in the genus as far as is known, in spreading out horizontally on the ground. When seen without flowers they can easily be mistaken for a species of *Brunsvigia*. In this respect *Boophane pulchra* also has an affinity with *Nerine marginata* Herb. which in addition has actinomorphic flowers, but its segments are spreading and not erect. A study of the chromosomes of these plants should produce some interesting results.

Brunsvigia herrei Leighton ex Barker sp. nov. (Amaryllidaceae)

Bulbus grandis, tunicis cartilagineis, collum etiam pars superior bulbi detectum. *Folia* 6, hysterantha; juniora erecta deinde diffusa, oblonga obtusa, glauca. *Pedunculus* ad 23 cm. altus et 1·5 cm. diam. *Umbella* ad 40-flora. *Perianthii* segmenta oblonga obtusa, pallide rubicunda, venulis atrioribus induta *Stamina* declinata, in ordinibus manifestis, longiora quam perianthium breviora, cetera dimidio longitudinis. *Ovarium* juvene obtuse 3-angulatum, deinde latum et apice acute angulatum. *Capsula* matura non visa.

Bulb large 10 cm. diam., covered with cartilaginous tunics, neck and upper part of bulb exposed. *Leaves* 6, hysteranthous, up to 20 cm. long and 9 cm. broad, oblong obtuse, glaucous green with narrow red margins; erect when young, finally spreading. *Peduncle* green, slightly compressed, up to 23 cm. high, 1·5 cm. diam. *Spathe valves* 2, ovate, pale greenish fawn, 6 cm. long, 3·5 cm. broad. Umbel up to 40-flowered. *Pedicels* pale green up to 18 cm. long, 5 mm. diam near base, tapered above, radiating to form a globose head. *Perianth* pale delicate pink with deeper veins and pale greenish keels; segments regular, oblong obtuse, up to 5·5 cm. long and 1·2 cm. broad; tube deep pink at base, 3 mm. long. *Stamens* declinate, in two distinct rows, the longest shorter than the perianth, the rest half as long; filaments without appendages, adnate to the perianth tube; anthers 5 mm. long before dehiscing. *Style* eventually slightly longer than the stamens. *Ovary* obtusely angled when young, ovate, 6 mm. diam., becoming acutely 3-angled, oldest 1·3 cm. broad when the last bud had opened. Capsule when fully developed not seen.

Holotype. *H. Herre* 3368 in Compton Herbarium, National Botanic Gardens, Kirstenbosch No. 67528 (flowers) March 1963, (leaves) Aug. 1963.

Namaqualand. Eselsfontein, Springbok, *H. Herre* 3368 (flowers) March 1963 (NBG and STE), (leaves) Aug. 1963 (NBG and STE), (flowers) March 1932 (BOL), (leaves) Sept. 1932 (BOL), (flowers) April 1933 (STE), (flowers) March 1934 (BOL), (leaves) Sept. 1934 (BOL), (flowers) April 1935 (BOL),

(flowers) March 1936 (BOL); Breekpoort, Steinkopf, *H. Herre* 3367 (flowers) March 1932 (BOL 23716); Bysonderend, Steinkopf Kloof, *H. Herre* 3369 (flowers with leaves added later) March 1932 (BOL).

This may be the *Brunsvigia* sp. mentioned by R. A. Dyer at the end of his review of the genus *Brunsvigia* Heist., in Plant Life, Vols. 6 and 7 (1950–1951) on p. 64 Vol. 7. The bulb from which the type specimens of *Brunsvigia herrei* were obtained, was collected in 1929 by Mr. H. Herre at Eselsfontein in the Springbok area, and had been cultivated in the Stellenbosch University Garden ever since. A number of specimens of inflorescences and leaves was sent to the Bolus Herbarium at various times for identification, where they were preserved and given the manuscript name *Brunsvigia herrei* by F. M. Leighton. In March 1963 one of the original bulbs was brought to the Compton Herbarium when in flower, where the inflorescence was photographed, described and preserved, and the bulb grown for leaves, in order to complete the type specimens and prepare the description for publication. Unfortunately it was not possible to obtain specimens of the mature capsules as well.

It has been noted that the inflorescence is larger than those of the earlier specimens in the Bolus Herbarium, and that the bulb is large and not medium sized as mentioned by Dyer. But the earlier inflorescences were preserved at a younger stage, and the larger size of the bulb can be accounted for after 32 years in cultivation.

Characters which assist in distinguishing the species are, the broad, obtuse scarcely undulate perianth segments, the stamens which are arranged in two very distinct rows, the short ones being only half as long as the rest, the few erect to spreading leaves, and the large bulb with the neck exposed above ground.

A NEW SPECIES OF PENAEACEAE

W. F. Barker

(*Curator, Compton Herbarium, National Botanic Gardens, Kirstenbosch*)

(With Plate XXXIII)

Brachysiphon petraeus sp. nov. Barker. (Penaeaceae).

Fruticulus parvus. *Rhizoma* crassum, in rimis saxorum coartum. *Ramuli* fere minus 24 cm. longi, vetusti infra sine foliis. *Folia* imbricata et decussata marginibus planis. *Inflorescentia* capitata, bracteis sterilibus coloratis ciliatis cincta, quam folia majoribus. *Flores* circiter 12 mm. longi tubo rubido 8 mm. longo; segmenta perianthii ovata subacuta nitide purpureo-rubicunda.

A dwarf undershrub. *Root-stock* thick, embedded in the crevices of weathered T.M.S. rocks. *Branches* shrubby, mainly from the base, usually less than 24 cm. long, erect, spreading or pendulous; older branches leafless below, with numerous leaf-scars, the upper part with imbricate, decussate leaves, erect to spreading or the lower ones sometimes recurved. *Leaves* 5—10 mm. long and 4—5 mm. broad, ovate to obovate, subacute with a dorsal apical gland, margins smooth; sessile or very shortly petiolate with two minute brown stipules and several minute brown setae in their axils. *Inflorescence* capitate, 1·5—3 cm. diam., consisting of 5—20 flowers surrounded by sterile, obovate cuneate bracts broader than the leaves and with reddish slightly ciliate margins. *Fertile bracts* tinged dark red-purple, the longest 12 mm. long and 10 mm. broad becoming progressively narrower towards the centre, from broadly cuneate to lanceolate cuneate. *Flowers* shortly petiolate; pedicels about 3 mm. long, with two linear bracteoles about 8 mm. long, attached at the centre. *Perianth* tube cylindrical, 8 mm., long and 3 mm. diam., rounded at the base, pale green tinged reddish, the colour becoming more intense upwards to dark red at the base of the segments; lobes 4—5 mm. long and 3 mm. broad, ovate sub-acute, slightly keeled in the upper half of the face, channelled towards the base, bright mauve pink, sub-erect to spreading when young, becoming erect and finally incurved when fading. *Anthers* subsessile, 1·5 mm. long and broad filaments very short; connective fleshy, white when young, fading bright reddish, a little longer than the anther cells. *Ovary* glabrous ovoid, 2 mm. long,; ovules 2 in each cell, erect; style filiform 7 mm. long; stigma small globose, finally exserted just beyond the anthers.

BRACHYSIPHON PETRAEUS Barker.

1. Branch, nat. size. 2. Flower, side view x5. 3. Flower, from above x5. 4. Longitudinal section of flower x5. 5. Petal x5. 6. Stamen, side view x10. 7. Stamen, front view x10. 8. Longitudinal section of gynaecium x5. 9. Bud x5. 10. Outer sterile bract, from within x5. 11 and 12. Inner sterile bracts, from without x5. 13. Fertile bract x5. 14. Leaf, back view x5. (*Rycroft* 1795.) *Del.* W. F. Barker.

PLATE XXXIII.
Holotype sheet in Compton Herbarium.
BRACHYSIPHON PETRAEUS Barker. H. B. Rycroft 1759

HOLOTYPE. *H. B. Rycroft* 1759 in Compton Herbarium, National Botanic Gardens, Kirstenbosch.

Flowering period: September-January.

CALEDON. S.E. of Kogelberg *Stokoe* 7973 (BOL); Rooi Els *Compton* 17529 (NBG), *Esterhuysen* 14122 (BOL), *Leighton* 1449 (BOL); Rooi Els River *Stokoe* (BOL 17343); Hazel Peak near Rooi Els *Davis* (SAM 65407); Mts. between Rooi Els River and Palmiet River *Stokoe* 530 (NBG, SAM and BOL); Mts. near Rooi Els and Hangklip *Stokoe* (SAM 52452); Hangklip Estates *Stokoe* (SAM 63584); Mt. N. of Pringle Bay *Rycroft* 1234 (NBG); Mountain slopes S.W. of Pringle Peak, growing only in T.M.S. rock crevices *Rycroft* 1759 (Holotype NBG); Pringle East Peak *Esterhuysen* 20399, 20726 (BOL); Pringle Peak *Macpherson* s.n. (NBG); Palmiet River Mouth *Compton* 12363 (NBG), *Salter* 5182 (K and BM), *van Rensberg* 2159 (BOL), *Pillans* 8223 (BOL); Palmiet River Valley *Stokoe* 8668 (BOL), *Stokoe* (SAM 65793), *Stokoe* (SAM 56519); Palmiet River *Martin* 384 (NBG); Palmiet River Mts. *Stokoe* (SAM 56246); Platteberg and Paardeberg near Palmiet River Mouth *Stokoe* 9216 (BOL); Kleinmond *Stokoe* (BOL 17538), *Compton* 3399 (BOL), *Compton* 3400 (BOL); Palmiet River Mts. Oudebosch *Stokoe* (SAM 65794); Near Elgin between Grabouw and the Paardeberg *Stokoe* (SAM 63583); Palmiet River, Elgin *Stokoe* 8440 (BOL).

Our first record of this charming little plant was made by Mr. T. P. Stokoe in 1922, on the mountains between Rooi Els River and the Palmiet River Mouth, and though it has been collected on numerous occasions since, by many different collectors, it has been left to languish without a name in the incertae of the Peninsula Herbaria. In Nov. 1954, Professor H. B. Rycroft brought good fresh material from Pringle Peak and suggested that it should be described, sketches were made at the time and the accompanying plate has been prepared from them.

It is allied to *Brachysiphon speciosus* Sond. in the set of the leaves and the congestion of the flowers into distinct heads surrounded by sterile bracts, but it is much less robust in habit, and its leaves are smooth-edged. Its habitat which suggested its name (growing among rocks) is also very distinctive, as it is known to occur only in crevices of weathered T.M.S. rocks, and it is often found jutting from vertical rock faces. This specialized habitat seems to be one of the controlling factors in its distribution, as it is recorded from altitudes varying from almost sea level to three thousand feet.

From present records it appears to be confined to the mountains West of Bot River. *Brachysiphon rupestris* Sond. is also found growing in the clefts of rock, but it seems to be confined to the mountains East of Bot River, is a much more dwarf plant, and does not have its flowers congested into distinct heads.

NOTES ON MESEMBRYANTHEMUM AND ALLIED GENERA

H. M. L. Bolus

Conophytum nordenstamii L. Bol. sp. nov. (*Euconophytum-Wettsteiniana*).—Plantae plures visae, caespitosae glabrae; vaginae persistentes anni prioris pallide brunneae vel partim griseae, apice saturate brunneo conspicue punctato; corpuscula obconica vel elongate obconica vel suboblonga, supra plana vel concava vel e margine os versus profunde declinata, pallide glauce viridia, sat inconspicue saturatioreque viridi punctata, punctis inter minimas visas, 9 mm. longa, apice 8 mm., basi 4 mm., diam., vel 1—1·3 cm. longa, apice 8—10 mm. diam., vel 1—1·3 cm. longa, apice 6 mm. diam.; flores diurni; pedunculi 5—7 mm. longi; bracteae basales obtusae, 1·5—2 mm. longae, vagina lobos aequante, sinu angusto; receptaculum ad 1·5 mm. longum, ad 1·75 mm. diam.; calyx ab initio fere omnino membranaceus, 6—7 mm. longus, tubo 4·5—5 mm. longo, inconspicue viridi nervato, nervis in segmenta 4 productis angustissimis, sed tamen marginibus membranaceis amplis; corolla ad 1·6 cm. longa, tubo superne leviter ampliato, albo, ad 1 cm. longo, segmentis ca. 3-seriatis, apice saepius rotundato, prope basim albis, deinde roseis, 1—1·75 mm. latis; filamenta ca. 4-seriata, e parum supra basim adnata, alba vel superiora pallide lutea vel rubra, antheris pollineque aureis; discus inconspicuus, segmentis truncatis; ovarium conice ad 0·5 mm. elevatum; stylus ad 11 mm. longus; stigmata 4, 1·5 mm., vel in flore unico ad 2·5 mm., longa; capsula supra visa obscure 4-angulata, infra semiglobosa albida, supra plana, medio tantum leviter elevata, suturis vix compressis, ad 4 mm., expansa 8 mm., diam.; semina late piriformia brunnea, ca. 0·5 mm. longa.

Cape Province: Namaqualand; Stinkfontein, Oct. 1962, *B. Nordenstam* 1243. N.B.G. 821/62. Fl. Apr. 1963.

Conophytum graciliramosum L. Bol. sp. nov. (*Derenbergia*).—Planta 1 visa, glabra, 6·3 cm. alta; rami graciles (itaque nomen), 3 cm. longi, 1·5—2 mm. diam., internodiis 4—5 mm. longis, in reliquiis vaginarum persistentium inclusis; corpuscula sat elongate cordata ob basim substipitatum, levia, saturate viridia, basim versus purpurea, ad 3·1 cm. longa, medio vaginae 9 mm. lato, prope apicem 1·3—2·2 cm. diam. cum divergio 5—12 mm. longo, lobis supra visis acutis, lat. visis rotundatis vel fere rotundatis, 8—12 mm. longis, basi 8 mm. lato et 6—9 mm. diam.; flores 2 visi; pedunculi 1·2—1·5 cm. longi; bracteae herbaceae acutae vel subobtusae, sinu angusto, 4 mm. longae, vagina lobos subaequante; receptaculum 2 mm. longum, 3 mm. diam.; calyx 1 cm.

longus, tubo membranaceo, viridi 5-nervato, 5 mm. longo, segmentis 5, herbaceis obtusis, brunneo viridibus, 4—5 mm. longis, ad 1·5 mm. latis; corolla 1·9 cm. longa, tubo superne leviter ampliato, albo vel in flore maturo pallide luteo, 9 mm. longo, segmentis 2—3-seriatis, apice rotundato, luteis, ad 1·25 mm. latis; filamenta ca. 6—7-seriata, e basi adnata, inferiora alba, superiora lutea, antheris pollineque pallide luteis; ovarium ad 1 mm. conice elevatum; stylus ab ovario non bene distinctus, ca. 2 mm. longus; stigmata 5, ad 9 mm. longa.

Cape Province: Namaqualand; Kuboos, Richtersveld, "collected in 1962, few specimens seen," *P. van Heerde*. Bolus Herb. 27416. Fl. hort. van Heerde Apr. 1963.

Conophytum supremum L. Bol. sp. nov. (*Derenbergia*).—Planta 1 visa, caespitosa, 11 cm. diam.; vaginae persistentes anni prioris pergamentaceae glaberrimae, intus politae, saturate brunneo punctatae, externe longitudinaliter transverseque rugosae, pallide brunneae, lobis induratis; corpuscula minutissime papillata, oblonge obovata, 3·4—4·2 cm. longa, apice 1·8—2·8 cm. diam. cum divergio 1—1·3 cm., vagina convexa ecarinata, 2·2—2·6 cm. longa, medio 9—12 mm. lato, apice, manu complanato, 1·9—2·7 cm. diam., lobis supra visis planis obtusis, lat. visis truncatis vel rotunde truncatis vel rarius rotundatis, 1·2—1·6 cm. longis, medio 4—5 mm. lato, e basi fere ad apicem 8—10 mm. diam.; pedunculi 1·5—2 cm. longi, 4 mm. e basi bracteati, bracteis carinatis acutis, tenuiter herbaceis, 9 mm. longis cum vagina 3 mm. longa, sinu angusto; calyx demum exsertus, fragilis, 9—10 mm. longus, tubo membranaceo, anguste viridi 5-nervato, 4 mm. longo, segmentis 5, obtusis vel subacutis, angustissimis sed tamen marginibus amplis, 4—6 mm. longis; corolla 2·2—2·7 cm. longa, tubo superne ampliato, albo, 7—8 mm. longo, segmentis 3—4-seriatis, obtusis luteis, 0·75—1·25 mm. latis; filamenta ca. 7-seriata, e basi tubi adnata, lutea, superiora breviter exserta, antheris pollineque aureis; ovarium acutissime conice ad 1—1·75 mm. elevatum; stylus 5—6 mm. longus; stigmata gracillima, 6—8 mm. longa; capsulae anni prioris infra obconicae, 5-angulatae, 4 mm., vel madidae 5 mm., longae, 4—5 mm., vel madidae ad 6 mm., diam., supra obtuse 5-angulatae, planae, medio tantum ad 1 mm. elevatae, primum conspicue saturate brunneo punctatae, suturis leviter compressis, expansa 1·2 cm. diam., valvis demum valde recurvatis.

Cape Province: Namaqualand; Richtersveld, "top of Kliphoogte," Jul. 1962, *P. van Heerde*. N.B.G. 892/62. Fl. Jun. 1963.

This species resembles **C. incurvum, C. simplum** and **C. umdausense** in that the lobes of the body are of the same diameter for their entire length or very nearly so; but they diverge much more at the apex and the sheath is shorter. It differs also in having the bodies glabrous and not velvety pubescent as in the species quoted above.

Conophytum gonapense L. Bol. var. **numeesicum** L. Bol. var. nov. (*Derenbergia*).—A forma typica lobis corpusculi lat. visis rotundatis praecipue differt.

Corpuscula ad 3·8 cm. longa, parte pellucida inconspicua, in latere altero subquadrata, maculis saturate viridibus cincta, in altero anguste cuneata; stylus ad 5 mm. longus; stigmata 7—8 mm. longa.

Cape Province: Namaqualand; Numees Beacon, Sept. 1962, *P. van Heerde*. Bolus Herb. 27389. Flor. hort. van Heerde Apr. 1963.

Conophytum tumidum N. E. Br. var. **asperulum** L. Bol. var. nov.—A forma typica corpusculis asperulis lobisque breviter papillate pubescentibus; calyce 5-lobato, segmentis 2 mm. longis; segmentis corollae ad 2 mm. latis; stylo 8 mm. longo; stigmatibus ad 3 mm. longis, differt.

Pedunculus 1·6 cm. longus, bracteis 4—6 mm. a basi positis, acutis herbaceis pallidis, ad 6 mm. longis, vagina 0·5—1 mm. longa (brevissima in genere adhuc notata).

Cape Province: Namaqualand; Ratelpoort, *H. Hall* 2416. N.B.G. 561/62. Fl. Jun. 1963.

This is the second collection to be recorded of this species, which was published in 1931, the exact locality in Namaqualand of the type being unknown.

Astridia dulcis L. Bol. sp. nov.—Planta 1 visa, 3 cm. alta; rami stricti, longissimus 7 paria foliorum ferens, internodiis 1·5—3 cm. longis, ad 5 mm. diam.; partes herbaceae glauce virides, mollissime velutinae, novellissimae fere villosae; folia demum patentia vel rarius erecta, adulta interdum subfalcata, supra visa plana, superne angustata, acuta vel obtusa, lat. visa prope apicem angustata, acuta vel rarius obtusa, in juvenilibus apice leviter recurvato, lateribus leviter convexis, carina saepius ad lineam reducta, 2·5—4·5 cm., vel rarius ad 6 cm., longa cum vagina 1·5 mm., eis sub bracteis brevissimis, medio ad 1 cm. lato et 8—14 mm. diam.; flores solitarii vel 3-nati, lateralibus bracteatis; pedunculi ad 6 mm. longi, prope apicem bracteati, bracteis lat. visis oblique ovatis, acutis vel obtusis, ad 1·4 cm. longis, manu complanatis ad 1·2 cm. latis, ad 8—9 mm. diam., marginibus non, vel obscure, excavatis; receptaculum late obconicum vel semiglobosum, 4—5 mm. longum, 6—8 mm. diam.; sepala carinata, extima 2 obtusa, interiora superne subulata, subula acuta, 8—9 mm. longa, basi 3—7 mm. lata; petala exteriora ca. 3-seriata, e parum supra medium inferne leviter angustata, obtusa, pallide rosea, ad 2·3 cm. longa, 1·5—2 mm. lata, interiora 4-seriata, acuta vel acuminata, in staminodia pauca gracillima, basim versus obscure papillata, transeuntia; filamenta ca. 6-seriata, alba, ad 9 mm. longa, interiora inferne ciliate, prope medium dense, papillata, antheris pollineque aureis; discus profunde denticulatus; ovarii lobi obtuse compressi, interdum discum fere attingentes, 0·5 mm., vel in flore senecto ad 1 mm., elevati, inter infimos in genere adhuc notatos; stigmata gracilia, longe papillata, ad

7 mm. longa cum cauda 1 mm. longa; capsula 1 visa, infra semiglobosa, supra ad 4 mm. elevata, suturis valde compressis, 1·1 cm., expansa 2 cm., diam., tuberculo sat parvo, pallido; semina breviter piriformia, echinata, saturate brunnea, ca. 1·25 mm. longa.

South-West Africa: "5 miles N. of Sendlings Drift," Mart. 1960, *H. Hall* 1869a. Fl. Feb.—Mart. 1963. N.B.G. 175a/60.

A. blandae valde affinis sed foliis lateraliter visis superne angustatis, in novellis apice leviter recurvato, praecipue differt.

Cephalophyllum middlemostii L. Bol. sp. nov. (*Reptantia*).—Cephala nulla; rami elongati reptantes, 2—3-angulati, demum albidi, 30 cm. longi vel ultra, ad 3 mm. diam., internodiis 1·5—4 cm. longis; folia inter gracillima in genere, supra visa plana, acuta vel acuminata, apiculata, acute carinata vel dorso rotundato, lat. visa acuta, viridia, saepius ad 3·2 cm., rarius ad 4·7 cm., longa cum vagina 2—3 mm. longa, in medio 1·5—3 mm. lata diametroque; ramuli floriferi ascendentes vel erecti, 2—3-fl., floribus lateralibus bracteatis, cum floribus 7—9 cm. longi; pedunculi infra medium bracteati, leviter intrusi, 4—6 cm. longi; receptaculum semiglobosum, 3 mm. longum, 6—7 mm. diam.; sepala 5, valde inaequalia, exteriora infra medium complanata, superne subulata, 8—10 mm. longa, basi 4—5 mm. lata, intima 4—5 mm. longa, basi 3 mm. lata; petala 3-seriata, infra medium vel prope basim leviter angustata, obtusa vel acuta, laete purpureo rosea, externe pallidiora, 1—2 cm. longa, 1—2 mm. lata; filamenta ca. 4-seriata, primum erecta conferta, mox sublaxa adque 7 mm. diam., alba, ad 3·5 mm. longa, antheris pollineque aureis; ovarii lobi fere erecti, superne castellatim compressi, ad 1 mm. elevati; stigmata 10—11, anguste subulata, 1·5—2 mm. longa; capsula anni prioris basi complanato, infra 4 mm. longa, supra ad 1·5 mm. elevata, 1 cm., expansa 1·9 cm., diam., suturis compressis, leviter ringentibus.

Cape Province; "Riversdale District," Apr. 1962, *A. J. Middlemost*. N.B.G. 259/62. Fl. per menses Maium Juniumque, 1963.

Cephalophyllum insigne L. Bol. sp. nov. (*Reptantia*).—Robustum; rami 3 visi, supra 2-angulati, infra rotundati, politi, pallide brunnei, ad 28 cm. longi, internodiis 1·5—3 cm. longis, ad 5 mm. crassis; ramuli steriles saepius 4-foliati, internodio incluso, floriferi cum floribus 6—11 cm. longi; folia erecta, supra visa apicem versus angustata, acuta vel subobtusa, inferne plana, superne leviter convexa, pustula basali conspicua, ecarinata vel carina ad lineam reducta, lateribus convexis, lat. visa superne non, vel leviter, angustata, apice rotundato, 3—8 cm. longa cum vagina ad 7 mm. longa, medio 4—6 mm. lato crassoque; flores ad 6·2 cm. diam., 1—2-nati, cymis bene evolutis non visis; pedunculi 3—4·2 cm. longi, basi bracteati, bracteis 1·3—1·7 cm. longis; receptaculum

semiglobosum, 3—4 mm. longum, 8—9 mm. diam.; sepala 5, basi 3—7 mm. lata, exteriora 2 carinata, lateribus subconvexis, e prope medium superne angustata, 1·2—1·8 cm. longa, interiora prope apicem obtuse subulata, 8—14 mm. longa; petala 2—3-seriata, e parum supra medium inferne angustata, obtusa rubicunda, inferne pallidiora, ad 2·8 cm. longa, 1·75—3 mm. lata; filamenta ca. 3—4-seriata, saturate rubra, basi breviter rubre papillato, antheris atro purpureis, polline sordide brunneo purpureo; ovarii lobi apicem versus subobtuse compressi, ad 1·75 mm. elevati; stigmata 10, gracilia, conspicue fimbriata, ad 3 mm. longa, cauda brevissima.

Cape Province: Namaqualand; Anenous Pass, Sept. 1959, *R. C. Littlewood.* Karoo Garden 357/59. Fl. Jul. 1960 et Jun. 1961.

Ruschia turneriana sp. nov.—Plantae 4, ferae visae, humiles caespitosae, 2—4 cm. altae, caule 5—10 cm. diam.; rami reliquiis multis dense vestiti, eis anni prioris induratis crassisque, senectis papyraceis; ramuli hornotini 2-foliati; partes herbaceae minute velutine pubescentes; folia erecta vel in ramulis florentibus leviter divergentia, supra visa plana, oblonga vel subovalia, acuta vel apice rotundato, lat. visa oblonga, apice subtruncato vel subrotundato, lateribus convexulis, carinata, marginibus carinaque ciliolatis, glauce viridia, ad 1·5 cm. longa cum vagina ad 5 mm. longa; pedunculi in receptaculum gradatim transeuntes, 5—6 mm. longi, basi bracteati, bracteis 5—6 mm. longis, foliis similibus; receptaculum subclavatum, 2—3 mm. longum, 3—4 mm. diam.; sepala 5, e basi superne angustata, apice obtuso vel subacuto, marginibus angustis, 3—4 mm. longa, basi 2—2·5 mm. lata; petala 3—4-seriata, intima pauca, primo in fascicula 5 disposita, inferne non, vel vix, angustata, acuta vel obtusa, roseo purpurea, 4—7 mm. longa, 0·5 mm., vel rarius ad 0·75 mm., lata; staminodia stamina longissima aequantia vel breviora, inferne rosea, superne roseo purpurea; filamenta 4—5-seriata, inferne pallida, superne roseo purpurea, extima prope basim obscure ciliate papillata, intima supra medium dense papillata; discus crenulatus; ovarium supra fere planum, lobis prope marginem ad 0·5 mm. elevatis, medium versus declinatis, obtuse compressis; stigmata 5—6, anguste subulata, ad 2·25 mm. longa cum cauda gracillima 1 mm. longa.

Cape Province: in dit. Vanrhynsdorp, "Knersvlakte, on a range of white phosphate rock in Mr. V. A. Turner's farm Varsrivier", Jul. 1963, *P. A. B. van Breda* 1912/63.

Ruschia klipbergensis L. Bol. sp. nov. (*Sarmentosae*).—Planta 1 visa, erecta, laxe ramosa, inter gracillimas in sectione, 33 cm. alta; rami ascendentes, superne saepe incurvati sed tamen in nullo modo sarmentosi, ad 30 cm. longi, internodiis 1—5·5 cm. longis, 1·5—4 mm. diam., novellis purpureis; folia

ascendentia, supra visa linearia acuta, carinata, lateribus convexulis, lat. visa litteram S elongatam saepe simulantia, apice saepius uncinate recurvato, 2·5—3·5 cm. longa cum vagina obscure impresse lineata 1—2 mm. longa, medio 2—4 mm. lato diametroque; flores 3-nati vel irregulariter 2-ternati; pedunculi 1·3—2·5 cm. longi, omnes bracteati, bracteis in medio vel infra medium positis, 5—8 mm. longis; receptaculum obconicum, prope medium leviter constrictum, deinde ampliatum, 3—4 mm. longum, 5—6 mm. diam.; sepala 5, acuta vel acuminata, 4·5—5 mm. longa, basi 3—4 mm. lata, interiora brunneo marginata; petala 3-seriata, inferne leviter angustata, acuta vel obtusa, rosea, marginibus vittaque roseo purpureis, 9—11 mm. longis, 0·75—1·25 mm. latis; staminodia ad stamina conice collecta appressa eaque subaequantia (collectione parum supra basim leviter constricta, inferne pallide rosea, superne roseo purpurea), cum filamentis extremis infra medium dense ciliate papillata, ad 4·5 mm. longa; filamenta intima prope apicem dense papillata, antheris pollineque albis; discus profunde divisus, segmentis acuminatis; ovarii lobi e disco erecti, obtuse compressi, ad 1·5 mm. elevati; stigmata 5, anguste subulata, 2 mm. longa cum cauda 1 mm. longa; capsula pallida, infra obconica, 10-costata, 5—6 mm. longa, supra ad 1·5—2 mm. elevata, suturis valde compressis, 7 mm., expansa 8 mm., diam., valvis erectis, tuberculo anguste oblongo, partem quartum oris loculi vix complente.

Cape Province; in dit. Darling; Klipberg, Jun. 1961, *H. Hall* 2227. N.B.G. 296/61. Fl. per annum totum a Jul. 1962 ad Aug. 1963.

Sphalmanthus praecox L. Bol. sp. nov. (*Eusphalmanthus*).—Planta 1 visa, per annos 3 et menses 3 culta; radix lignosa, 5 cm. longa, 11 mm. diam.; rami demum ca. 80 cm. longa, ad 4 mm. diam., foliis omnibus alternis; ramuli floriferi autem, per annos 2 culti, interdum paria foliorum oppositorum ad 4 ferentes, pare supremo etiam florem et gemmas axillares subtendente, 10—21 cm. longi; partes herbaceae sat conspicue papillatae, papillis rotundatis; folia lat. visa obtusa, vel apice rotundato vel in juvenilibus truncato, adulta 2·5—3·5 cm. longa, 1·5—3 mm. diam.; pedunculi 1·5—2 cm. longi; calycis tubus ca. 1 mm. longus, segmentis 5, apice rotundato, 9—18 mm. longis; corolla non bene visa, ca. 1·4 cm. longa, in alabastro pallide salmoneo rosea, cum aetate pallide brunnea ("buff"); filamenta rubra, antheris pollineque luteis; ovarium leviter elevatum; stigmata 5, ca. 1·5 mm. longa; capsula matura sponte expansa (fide Littlewood), itaque nomen.

Cape Province: Namaqualand; "15 miles N. of Concordia, Sept. 1959," *R. C. Littlewood.* Karoo Garden 359/59. Fl. Oct. 1961.

The occurrence of the spontaneous expansion observed by Mr. Littlewood in the capsule of this species is the first to be recorded in **Sphalmanthus.**

Mr. Hall has observed the same spontaneous expansion occurring in the

fruit of **Stoeberia carpii**. In his most interesting notes on this genus he states that: "the fleshy ovary, unlike that of most other 'Mesems.', only takes about 25 days to dry and mature, and that even while still partly fleshy the valves of the fruit commence opening. The peduncle tends to curve to one side, perhaps to facilitate the emission of the seeds which pour out freely at a later stage in the curving. The tall stems sway readily in a stiff breeze and in a few days the capsules are completely empty. They show no visible response to wetting, as they do in those of the vast majority of the *Mesembrieae*, which would suggest that rain plays no part in this well known seed-dispersal mechanism. This is of interest when it is realized that the rainfall is very scanty in its native habitat. But there are, of course, many other types of the *Mesembrieae* in the same area, among them being **Delosperma, Astridia, Ruschia** and **Eberlanzia**, which depend entirely on rain for seed-dispersal.

The plants of **Stoeberia carpii** brought for cultivation at Kirstenbosch in 1960, have retained their very erect habit, producing their unbranched flowering stems up to 3 feet in height in a few weeks in the spring. The internodes may be up to 5 inches in length. The glaucous colour of the leaves is maintained. About 15 flowers form successively in a loose cyme about 4—5 inches in diameter, remaining fully expanded night and day for about 10 days, with their diameter finally up to $2\frac{1}{2}$ inches."

Mr. Hall has also observed that: "In the genus **Scopelogena** from the Cape the capsules when dry release their seeds and also remain permanently open after reaching the dried state."

ADDITIONAL NOTES

Ophthalmophyllum noctiflorum L. Bol.—This species, somewhat resembling **Conophytum pillansii** in its fenestration, is interesting as being in its floral structure more closely allied to the night-flowering species in the subgenus EUCONOPHYTUM Schwant. than any other **Ophthalmophyllum** hitherto described and it might, therefore, be regarded as the earliest species to appear in the evolution of this genus. For, apart from the adnation of the basal part of the calyx-tube to the corolla-tube, which is the only constant characteristic separating this genus from all the rest of the *Mesembrieae*, the structure is completely that of a typical **Conophytum.** For example: the bracts are short, thus differing from the long ones, with their fenestrate tips sometimes exserted from the body, as in typical **Ophthalmophyllum**; and the receptacle is not produced into a tube so that the nectary is above the height of the ovary, as it usually is in this genus, a characteristic it shares with **Argyroderma**. The nectary throughout the *Mesembrieae* (whether it be anular or composed of separate glands or pits) marks the apex of the receptacle and the point of insertion of the stamens corolla and calyx.

Conophytum sulcatum L. Bol. with its bilobed body is another interesting species in that it might be a primitive form of the well defined group in EUCONOPHYTUM containing **C. ectypum** and its close allies, just as **C. luckhoffii** might represent a primitive form of the series *Minuscula* in the subgenus CELATISTAMINA. Other such forms occurring in the same subgenus are **C. areolatum** and **C. boreale** in the series *Fenestrata.*

In the same way the entire series *Cordiformia* of the subgenus DERENBERGIA is composed of primitive forms of **Conophytum** as represented by the type **C. truncatum** N. E. Br., where the two leaves forming the body are completely fused, forming a closed sheath except for the slit or orifice in the middle of the flattened apex of the body through which the flower emerges. In the primitive forms the two leaves are united in the lower part to form the sheath with the orifice at its apex, and their upper section is free. These sections are known as the lobes of the body and in side view are infinitely variable in shape, divergence and length, thus affording some of the best characters that are used for separating the species. At the apex of the sheath there is a pellucid, or somewhat pellucid, area, reaching the extremities of the orifice, which is also variable and is occasionally surrounded by dots. (In typical **Conophytum** a concentration of dots at the extremities of the orifice frequently occurs, and in the series *Cataphracta* depressions or "dimples" sometimes replace them.) The giants of the genus **Conophytum** are found in this series, the largest body to be recorded being 6·5 cm. long with the lobes 2 cm. long. The bodies are nearly always more or less compressed so that their diameter is usually greater than their breadth. But it has been the practice of some authors to erroneously call the diameter of the body its breadth and the latter its thickness. In the description of **C. elishae** N. E. Br., for example, the bodies are stated to be "7—14 lines long, 6—10 lines broad and 5—8 lines thick." This has caused some confusion. Another practice that has also led to confusion is connected with the terms "cordate" and "obcordate." Continental botanists rightly regard the narrow end of the heart as its base and British botanists erroneously, the broad end. For instance, the cordate body of **Conophytum dennissii** N. E. Br. and that of **C. longibracteatum** L. Bol. are both described as being obcordate.

The *Cordiformia* are concentrated in Namaqualand, especially in the northern areas, Leliefontein being the most southerly station recorded. North of the Orange River they are represented by **C. ernianum** and **C. taylorianum,** both with a pink corolla. In Dr. Tischer's classification of **Conophytum** the two remaining series *Ovigera* and *Saxetana* contain the smaller species of DERENBERGIA. Here also the gradual diminution in the length of the lobes may be traced until in the border-line species these almost disappear, and it becomes difficult to decide whether they should be placed in DERENBERGIA or EUCONOPHYTUM. **C. australe,** where the lobes are absent or scarcely up to 1 mm. long in bodies of the same collection, is an example of such a case.

Conophytum praecox N. E. Br. This species was published in 1931, the locality given being Namaqualand. Since then the following collections, all from Namaqualand and represented in the Bolus Herbarium, have been made: Stellenbosch University Garden 9660, "29 miles from Port Nolloth," *H. Herre*. Fl. April 1933; N.B.G. 410/61. Richtersveld, Rooiberg, *A. J. Middlemost*. Fl. May 1962 and March 1963; N.B.G. 820/62. Richtersveld Klein Hellskloof, *B. Nordenstam* 1218. Fl. April 1963.

A second collection of **Delosperma esterhuyseniae** L. Bol. was made in the Langkloof, Humansdorp Division, by *M. Mohrhardt* in July 1962 which flowered in the University Botanic Garden, Stellenbosch in July 1963. S.U.G. 14775.

NOTE.—The type specimens of all new species and new varieties described in this paper are in the Bolus Herbarium, University of Cape Town, Rondebosch.

(*To be continued.*)

THE NOMENCLATURE OF *PROTEA MACROCEPHALA* THUNB.

H. B. Rycroft

(National Botanic Gardens of South Africa, Kirstenbosch)

(With Plates XXXIV—XXXV)

In Flora Capensis (Dyer V, i, 1912) Phillips and Stapf state that "if *Protea macrocephala* Thunb., the original of which we have not seen, should really prove to be identical with R. Brown's *P. incompta*, as is very probable, the former name would have to stand."

While examining specimens in the Thunberg Herbarium in Uppsala at the end of 1960 a specimen listed as *P. macrocephala* in Thunberg's hand was found. This is the holotype of the species. On the sheet is a label on which Phillips wrote the name "P. incompta R. Br." It is not dated and it can only be concluded that Phillips saw the specimen after the publication of Vol. V of Flora Capensis in 1912. This is unlikely because it is known that Phillips investigated the genus Protea at Uppsala in July 1910.

The earliest reference to this species is in Boerhaave (Ind. Plant. Hort. Ludg. Bat. ii, 189, t.189, 1720) and the figure is a good and recognisable representation of the species. Linnaeus in his Species Plantarum ed. i, 91 (1753) cited the same plate as his *Leucadendron lepidocarpodendron β*.

The first to apply the epithet "incompta" or "incomptum" was Salisbury in Knights Prot. 37 (1809) who named this species *Erodendron incomptum*, and wrote that it occurred at the foot of the mountains near Rondebosch, which in fact it does.

This species with its green bracts assumes the habit of a shrub or small tree and is to be found along the coastal belt between the mountains and the sea from the Worcester area southwards to the Cape Peninsula and then eastwards to the Humansdorp area.

It usually flowers from April until about August.

The name *Protea macrocephala* published by Thunberg in Hoffm. Phytogr. Blaett., i, 13 (1803) takes precedence over Robert Brown's *P. incompta* in Trans. Linn. Soc., X, 83 (1810).

The Holotype is Thunberg Cap. b. Spei in the Thunberg Herbarium, Uppsala, Sweden.

SYNONYMY

PROTEA MACROCEPHALA *Thunb.* in Hoffm. Phytogr. Blaett., i, 13 (1803), Nov. Act. Acad. Sci., Imp., Petropol. XV, 464 (1806), Fl. Cap. ed. I, 506 (1813), ed. II, 506 (1818), ed. Schult., 138 (1823); *Dietr.* Bollst. Lex. Gart. Bot. 540 (1807).

Leucadendron lepidocarpodendron *β Linn.* Sp. Plant. ed. I, i, 91 (1753), ed. II, 134 (1762), ed. III, i, 134 (1764).

Leucadendron lepidocarpodendron var. Burm. f. Prodr. Fl. Cap. 3 (1768).

Protea coronata *Lam.* III. Gen. i, 236, excl. ref. to Boerh. t. 186 (1792); *Poir.* Encycl. Meth v, 645, excl. ref. to Boerh. t. 185 (1804).

Erodendrum incomptum *Salisb. ex Knight* Prot. 37 (1809).

Protea incompta *R. Brown* in Trans. Linn. Soc. X, 83 (1810); *Poir.* Encycl. Meth. Bot. Suppl. iv, 561 (1816); *Roem et Schult.* Syst. Veg. iii, 347 (1818); *Link* Enum. Plant. Alt. i, 112 (1821); *Steud.* Nomencl. Bot. ed. I, 659 (1821); *Poir.* in Diet. Sci. Nat. xliii, 391 (1826) *Roem. et Schult.* Syst. Veg. iii Mant. 264 (1827); *Sweet* Hort. Brit. 346 (1827); *Loud.* Encycl. Plant. 80 (1829), Hort. Brit. 38 (1830); *Steud.* Nomencl. Bot. ed. II, ii, 400 (1841); *Endl.* Mant. Bot. Gen. Plant Suppl. ii, 77 (1842); *Drege* Zwei. Doc. 104, 124, (1843); *Meisn.* in DC. Prodr. XIV, 234 (1856); *Phill. et Stapf.* in Dyer Fl. Cap. V, i, 564 (1912); *Adamson et Salter* Fl. Cap. Pen. 323 (1950); *Kidd* Wild Flow. Cap. Pen. t. 34 (1950); *Vogts* Prot. t. 56 (1958).

P. incomta *Spreng.* Syst. Veg. ed. XVI, i, 462 (1824).

P. incorrupta *Krauss* Beitr. Fl. Cap. et Nat. 139 (1846)

P. incompta f. dregei *Gandoger* in Bull. Soc. Bot. France xlviii, c. (1901).

P. incompta f. zeyheri *Gandoger* in Bull. Soc. Bot. France xlviii, c. (1901).

P. incompta var. susannae *Phill.* in Dyer Fl. Cap. V, i, 564 (1912). PRE-LINNAEAN CITATIONS.

Lepidocarpodendron; folio saligno viridi; nervo et margine flavo; etc; *Boerh.* Ind. Plant. Hort. Lugd. Bat. ii, 189, t. 189 (1720).

Scolymocephalus seu lepidocarpodendron frutice conifero *β. Weinm.* Phyt. iv, 291, t. 898 (1745).

DISTRIBUTION.

WORCESTER: Du Toit's Kloof, *Esterhuysen* 20175 (BOL).

PAARL: French Hoek, *Phillips* 1262 (SAM, *Steer*, 797 (PRE).

STELLENBOSCH: Jonkershoek, *Rycroft* 1278 (NBG).

CAPE: Devils Peak, *MacOwen* Herb. Norm. Aust. Afr. 785 (BOL, BM, E, G, K, P, UPS, Z), *Bolus* 4575 (BM, K, MO, Z), *Ecklon* 652 (B, HAL, K.M.), *Pillans* 10067 (MO), *Kuhl & Hasselt* "*P. obliqua*" (L), *Mund* "*P. incompta*

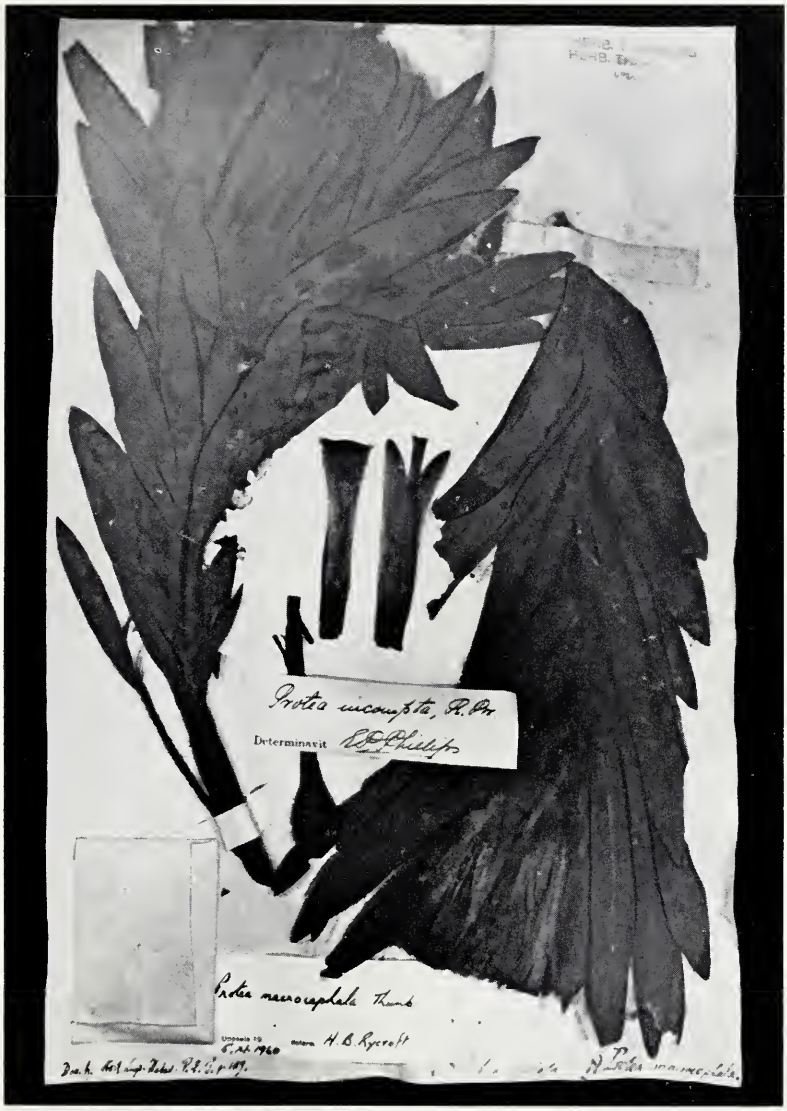


PLATE XXXIV. Holotype of *Protea macrocephala* in the Thunberg Herbarium, Uppsala. Ph. H. B. Rycroft.

PLATE XXXV. FIG. 1. Illustration of Lepidocarpodendron folio saligno, viride, etc. in *Boerhaave* Ind. Pl. Hort. Ludg. Bat. ii, t.189 (1720)

Ph. H. B. Rycroft.

PLATE XXXV. FIG. 2. *Protea macrocephala* Thunb. Illustration by Fay Anderson.

Ph. H. B. Rycroft.

Brown β albida Kl." (B); *Wilms.* 3566 (G, K); Block House, *Marloth* 1741b (PRE); near Cape Town, *Rogers* 16186 (K); *Fry* in Herb. Galpin 5019 (K, PRE); Cape Town, *Prior* (K, PRE), *Ostenfeld* (C), *Zepher* 3659 (P); Cape Flats, *Rehmann* 2077 "*P. speciosa* Thb." (Z); Lion's Head, *Drege* (CGE, HAL, K, S), Dümmer (E); Table Mountain, *Thunberg* (S), *Drege* (MO), *Fleck* "*P. hirsuta*" Br. (Z), *Bergius* (B, HAL), *Humbert* 9630 (PRE); between Table Mountain and Lion's Head, *Krauss* (M); Kirstenbosch, *Humbert* 9658 (PRE), Meebold 152 (M); above Kirstenbosch, *Hutchinson* 38 (BOL, K, PRE); Hout Bay, *Dümmer* 1465 (E); Hout Bay Nek, Gamble 22065 (K).

WYNBERG: Wynberg, *Roxburgh* 6 (syntype of *P. incompta* R. Br.) (BM), *Roxburgh* 26 "P. plumosa" in *herb. Lambert* (G); between Rondebosch and Wynberg, *Burchell* 772 (K).

SOMERSET WEST: Helderberg, *Parker* 3685 (BOL, K, NBG); Sir Lowry's Pass, Solly in SAM 52841 (SAM).

CALEDON: Kaaimansgat, Villiersdorp, *Rycroft* 2229 (NBG); Paardeberg, *Stokoe* in SAM 65158 (SAM); Genadendal, *Verreaux* (G).

RIVERSDALE: Garcia, *Esterhuysen* 17276 "*P. incompta var. susannae*" (BOL); Langeberg, *Muir* 390 (Syntype of *P. incompta* R. Br. var. *susannae* Phill.) (BOL, K, PRE, SAM).

GEORGE: George, margin of forest, *Bowie* (BM); George, *Prior* (K); Barbier's Kraal near George Town, *Bowie* (BM).

HUMANSDORP: Witte Els Bosch, *Fourcade* 786 (BOL, K, PRE); Kareedouw Pass, *Acocks* 13683 (K, PRE), *Wurts* 2079 (NBG); 17 miles west of Humansdorp, *Sidey* 1719 (MO); Plettenberg Bay, *Werdemann & Oberdieck* 1009 (B); Humansdorp, *Fourcade* 3373 (PRE), *Thode* A987 (PRE).

UITENHAGE: Zuurberg Mts., *Fries, Norlindh & Weimarck* 626 (NBG).

WITHOUT LOCALITY: *Thunberg* (UPS), holotype, (S); *Sieber* I (B, BR, G-DC, HAL, K.L.M.P.); "*P. coronata* Lam" in herb Lamarck (P-LA); *Drege* 183 (B), (BM, G-B, G, P, L), 3638 "*P. incompacta* R. Br." (FI), *P. grandifl. β angustifol Ker b*" (MO); *Bergius* "*P. incompta* var ∝ *viridis*" (K); *Delessert* (UPS); *Ecklon* "*P. formosa* R. Br." (S); *Sonnerat* (P); *Verreaux* (G. G-B, P); *Zeyher* 3638 "P. *melaleuca* R. Br." (P), 3659 (G-B); *Oldenburg* 61A (syntype of *P. incimpta* R.Br.) (BM).

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INDEX OF PLANT NAMES

Note: New species etc. are printed in bold type. An asterisk indicates that the article is illustrated.


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